GOVERNOR'S ADVISORY COMMITTEE ON CHIP MILLS

FINAL REPORT

August 1, 2000

EXECUTIVE ORDER

98-16

WHEREAS, the forest resources of Missouri are vital to Missouri's citizens because they provide timber, wood products, fish and wildlife habitat, outdoor recreation and tourism opportunities, protection of soil and water resources, and support the general health and quality of life; and

WHEREAS, economic enterprises and other activities utilizing forest resources warrant the continuing recognition and support of the state; and

WHEREAS, it is in the public interest of the State of Missouri to encourage and apply Best Management Practices for responsible forest resource management that serves both (1) the public's need for timber and other forest products, and (2) the public's need for soil and water resource protection, fish and wildlife habitat preservation, recreational and tourism opportunities, and a healthy environment for present and future generations; and

WHEREAS, a "chip mill" is a facility that uses forest resources for the primary purpose of producing wood chips for markets inside and outside the United States; and

WHEREAS, concerns with the operation of chip mills in other states has generated questions about a variety of adverse environmental impacts caused by indiscriminate forest resource harvesting practices, including soil erosion, increased sediment in streams, and alteration of the natural forested landscape; and

WHEREAS, the introduction of chip mills into Missouri and neighboring states has led to concerns from citizens throughout Missouri relating to the proper use of our forest resources and the conservation and management of Missouri's natural resources;

NOW, THEREFORE, I, MEL CARNAHAN, Governor of the State of Missouri, by virtue of the authority vested in me by the Constitution and laws of the State of Missouri, do hereby declare that:

1. All executive departments and agencies of the State of Missouri shall work cooperatively so that the governmental administration of forest resources combines professional management services, regulatory measures, and economic incentives in a complementary fashion to meet the purposes of this executive order.

2. All executive departments and agencies of the State of Missouri shall apply forestry Best Management Practices, as included in the 1997 Missouri Watershed Protection Practice Guidelines (published by the Missouri Department of Conservation), in the management of all properties owned, controlled, or managed by these agencies to meet the purposes of this executive order.

3. The State of Missouri recognizes the benefits of the forest industry's Sustainable Forestry Initiative and encourages all forestry corporations operating in the state to participate in these standards.

4. An Advisory Committee on Chip Mills is hereby established. The Advisory Committee on Chip Mills shall initiate a study to identify the impact of chip mills and the associated forest harvesting practices. The study initiated pursuant to this executive order shall include, but not be limited to an analysis of:

   a. the experiences in other regions of the United States with the operation and forest resource harvesting practices of chip mills;
   b. the impact to Missouri's natural resources from new and existing chip mills in Missouri or neighboring states, including current and potential social, economic, and environmental impacts;
   c. the potential environmental impacts, including soil erosion, sedimentation, water quality, watershed protection, habitat loss, biological diversity, outdoor recreation and tourism,

and the additional requirements that may need to be incorporated into any permit process to provide protection against such impacts;

d. the sustainability of Missouri's forest resources under current timber production levels;
e. the capacity of Missouri's forest resources to sustain increased chip mill production levels;
f. the impact of chip mills on value added industries and high value forest products; and
g. the long-term profitability of private forests.

5. The purposes of the Advisory Committee shall also include:

   a. developing a consensus around the study results and providing an opportunity for public involvement; and
   b. reviewing forest resource management and protection standards, policies and processes in Missouri and other jurisdictions to identify alternatives for assuring economic and environmental sustainability.

6. The Advisory Committee on Chip Mills shall submit its final study, including recommended reforms, to the Governor no later than December 1, 1999. The Advisory Committee shall automatically cease to exist on that date, unless extended by subsequent executive action. By January 1, 1999, the Committee shall make any interim recommendations for legislative or regulatory action necessary to prevent irreparable harm to the environment.

7. The Advisory Committee on Chip Mills shall be co-chaired by the Directors of the Department of Natural Resources and Department of Conservation, or their designees, with the assistance of the Directors of the Departments of Economic Development and Agriculture, or the directors' designees. These Departments shall provide appropriate staffing to support the activities of the Advisory Committee. The Attorney General's Office is requested to provide legal advice and assistance to the Advisory Committee.

8. The Advisory Committee on Chip Mills shall work cooperatively with all committees of the Missouri General Assembly convened for the purpose of studying and addressing the impact of chip mills in the State of Missouri.

9. All proceedings of the Advisory Committee on Chip Mills shall be conducted in accordance with the "Open Meetings Law" as provided in Chapter 610, RSMo.

10. The Departments of Natural Resources, Conservation, Economic Development, and Agriculture shall develop a funding means to reimburse members of the Advisory Committee on Chip Mills for their actual and necessary expenses and other costs connected with Advisory Committee business.

11. The Advisory Committee on Chip Mills shall be composed of 14 members appointed by the Governor consisting of the following:

   - The director of the Department of Natural Resources or the director's designee;
   - The director of the Department of Conservation or the director's designee;
   - The director of the Department of Economic Development or the director's designee;
   - The director of the Department of Agriculture or the director's designee;
   - Two (2) state representatives appointed by the Speaker of the House of Representatives;
   - Two (2) state senators appointed by the President Pro Tem of the Senate;
   - Two (2) forest products representatives;
   - Two (2) representatives of citizen environmental conservation groups;
   - A forest landowner;
   - A representative of an organization representing private property owners; and
   - Any other members which the Governor may, from time to time, appoint.

12. From the date of this executive order until the Committee makes its recommendations to the Governor, all executive departments and agencies of the State of Missouri shall refrain from providing new economic incentives to develop or expand chip mills in the State of Missouri.

12. From the date of this executive order until the Committee makes its recommendations to the Governor, all executive departments and agencies of the State of Missouri shall refrain from providing new economic incentives to develop or expand chip mills in the State of Missouri.

13. Because chip mill operations and associated forest harvesting practices can result in increased soil erosion and water quality degradation during the period of the study, I am directing the Department of Natural Resources to:

    a. condition future permits to require logger training of all contractors and employees of chip mills in the use of sustainable logging practices and Best Management Practices designed to protect water quality;
    b. include a requirement in future permits for chip mills to provide the location of supplies and harvest areas of forest resources to be processed. This would give professional forest resource managers the opportunity to offer assistance in developing sustainable forestry plans and Best Management Practices to protect water quality;
    c. include in future permits "Re-Open Clauses" that would allow reopening permits in order to address documented adverse impacts resulting from industry operations; and
    d. limit the duration of permits related to the operation of chip mills to no greater than one year from the date of permit issuance.

IN WITNESS WHEREOF, I have hereunto set my hand and caused to be affixed the Great Seal of the State of Missouri, in the City of Jefferson, on this 18th day of September, 1998.

GOVERNOR

ATTEST:

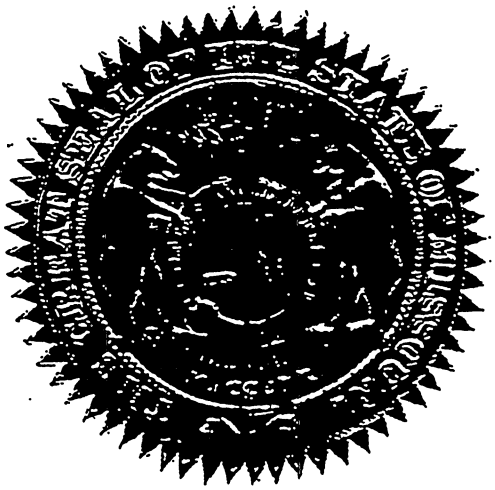
SECRETARY OF STATE

EXECUTIVE ORDER
99-11

WHEREAS, in Executive Order 98-16 the expiration date for the Missouri Governor's Advisory Committee on Chip Mills is December 1, 1999; and

WHEREAS, it has been identified and communicated to me that it is necessary to extend the expiration date of the Committee.

NOW, THEREFORE, I, Mel Carnahan, Governor of the State of Missouri, by virtue of the authority vested in me by the Constitution and laws of the State of Missouri, do hereby amend Executive Order 98-16 and extend the expiration date to February 1, 2000.



In WITNESS WHEREOF, I have hereunto set my hand and caused to be affixed the Great Seal of the State of Missouri, in the City of Jefferson, on this 24th day of November, 1999.

Mel Carnahan
GOVERNOR

ATTEST:

Rebecca McDowell Cook
SECRETARY OF STATE

EXECUTIVE ORDER
00-01

WHEREAS, on the 18th day of September, 1998, I issued Executive Order 98-16 which created the Advisory Committee on Chip Mills; and

WHEREAS, in said executive order I declared that all executive departments and agencies of the State of Missouri shall work cooperatively so that the governmental administration of forest resources combines professional management services, regulatory measures, and economic incentives in a complementary fashion to meet the purposes of this executive order; and

WHEREAS, the study ordered to be conducted by the Advisory Committee on Chip Mills was to include but not be limited to an analysis of:

a. the experiences in other regions of the United States with the operation and forest resource harvesting practices of chip mills;

b. the impact to Missouri's natural resources from new and existing chip mills in Missouri or neighboring states, including current and potential social, economic, and environmental impacts;

c. the potential environmental impacts, including soil erosion, sedimentation, water quality, watershed protection, habitat loss, biological diversity, outdoor recreation and tourism, and the additional requirements that may need to be incorporated into any permit process to provide protection against such impacts;

d. the sustainability of Missouri's forest resources under current timber production levels;

e. the capacity of Missouri's forest resources to sustain increased chip mill production levels;

f. the impact of chip mills on value added industries and high value forest products and the long-term profitability of private forests; and

WHEREAS, the Committee was also charged with developing a consensus around the study results and providing an opportunity for public involvement and reviewing forest resource management and protection standards, policies and processes in Missouri and other jurisdictions to identify alternatives for assuring economic and environmental sustainability; and

WHEREAS, in Executive Order 98-16 I directed all executive departments and agencies of the State of Missouri to apply forestry Best Management Practices, as included in the 1997 Missouri Watershed Protection Practice Guidelines (published by the Missouri Department of Conservation), in the management of all properties owned, controlled, or managed by these agencies to meet the purposes of said executive order; and

WHEREAS, I have been advised that in December, 1998, staff in the Missouri Department of Conservation prepared a "Draft Report on the Chip Mill Issue" and submitted it to Missouri Department of Conservation Director Jerry Conley and Missouri Department of Conservation Deputy Director John Smith; and

WHEREAS, the Missouri Department of Conservation did not present their report to the Advisory Committee; and

WHEREAS, Executive Order 99-11 extended the authority of the Advisory Committee only until February 1, 2000.

NOW, THEREFORE, I, MEL CARNAHAN, Governor of the State of Missouri, by virtue of the authority vested in me by the Constitution and laws of the State of Missouri, do hereby amend Executive Orders 98-16 and Executive Order 99-11 as follows:

1. The Advisory Committee shall continue its operation until it has carefully and thoroughly examined and reviewed the Missouri Department of Conservation Draft Report on the Chip Mills Issue, dated December 1998, submitted to Director Conley and Deputy Director Smith, but not presented to the Advisory Committee Co-Chair Mahfood until the last week of December, 1999, in order to assist the Committee in drafting its final recommendation. This examination and review should include public hearings on

the draft report in order to give Conservation Commissioners who have not seen the report, the Conservation staff who prepared the report, as well as any members of the public sufficient time to review the report and present their views to the Advisory Committee.

2. Paragraph 7 of Executive Order 98-16 is amended to read as follows:

7. The Advisory Committee on Chip Mills shall be co-chaired by the Directors of the Department of Natural Resources and Department of Conservation, with the assistance of the Directors of the Departments of Economic Development and Agriculture. The co-chairs shall not appoint Designees to carry on their duties as co-chairs without prior authorization by my chief of staff. These Departments shall provide appropriate staffing to support the activities of the Advisory Committee. The Department Directors shall not be permitted to appoint designees to carry out this directive without prior authorization by my chief of staff. The Attorney General's Office is requested to continue to provide legal advice and assistance to the Advisory Committee.

3. Paragraph 11 of Executive Order 98-16 is amended to read as follows:

11. The Advisory Committee on Chip Mills shall be composed of 14 members appointed by the Governor consisting of the following:

- The director of the Department of Natural Resources;
- The director of the Department of Conservation;
- The director of the Department of Economic Development;
- The director of the Department of Agriculture;
- Two (2) state representatives appointed by the Speaker of the House of Representatives;
- Two (2) state senators appointed by the President Pro Tem of the Senate;
- Two (2) forest products representatives;
- Two (2) representatives of citizen environmental conservation groups;
- A forest landowner;
- A representative of an organization representing private property owners; and
- Any other members who the Governor may, from time to time, appoint.

IN WITNESS WHEREOF, I have hereunto set my hand and caused to be affixed the Great Seal of the State of Missouri, in the City of Jefferson, on this 20th day of January, 2000.

GOVERNOR

ATTEST:

SECRETARY OF STATE

EXECUTIVE SUMMARY

In September, 1998, Governor Mel Carnahan appointed an Advisory Committee on Chip Mills to investigate the potential environmental, economic and social impacts of two high capacity chip mills that had recently located in the state. In July, 2000, the Advisory Committee conducted its last meeting prior to submitting its final report to the Governor. The Committee was comprised of 14 members including legislators, conservation and natural resource agency officials, and industry, environmental and landowner representatives with an interest in the status and management of the state's forest resources. The Committee met 17 times from November 1998 through July 2000 and also held three public hearings during that period. Committee meetings and hearings also served as a public forum in which, through testimony and written comments on report drafts, citizens were able to express their varying concerns about the 'chip mill issue.' The result was an unprecedented level of public input for a natural resource-related function of this nature in Missouri.

This report is organized in three parts. Part I describes the nature of the 'chip mill issue' in Missouri, the establishment and make-up of the Governor's Advisory Committee, and its mission and activities. Part II provides a compilation of background information relevant to Missouri forest resources, chip mills and forest industry in the state, forest practices on nonindustrial private lands, environmental sustainability in the context of all of the above, education and information dissemination efforts directed at Missouri forest landowners, landowner rights and responsibilities, and experiences with chip mills in other states. Part III contains 35 recommendations issued by the Governor's Advisory Committee towards addressing the chip mill issue in Missouri.

I. INTRODUCTION

Within the last five years, two high-capacity chip mills – defined as those capable of producing at least 150 thousand tons of wood chips per year as their primary output – have set up operations in Southeast Missouri. Expected combined chip production of the two mills is anticipated to range in the area of 500 thousand tons per year. Prior to the arrival of the mills, the state's wood products industry had been comprised primarily of many small sawmills producing lumber and related products.

Almost 85% of Missouri forestlands are controlled by more than 300 thousand nonindustrial private forestland owners. Approximately three-quarters of the land area surrounding the two high-capacity mills is privately owned. Thus the majority of wood that will be procured by these mills will come from nonindustrial private forestlands. At the same time, it is currently estimated that only between 10 and 15% of private forestland owners seek or receive advice or assistance from a professional forester when harvesting timber from their lands.

An overview of the 'chip mill issue' in Missouri may be summarized as follows. In Missouri, pulpwood has traditionally been regarded as low quality wood for which markets were extremely

limited. As a result, such wood was either left on-site after timber harvests or, when economically feasible, sent to pallet or blocking mills. At the same time, through historical circumstances and lack of management by private landowners, Missouri forests contain a large amount of low quality trees not suitable for lumber or other wood products traditionally produced in the state. From this perspective, some view the arrival of the chip mills as creating a viable market for this low-grade, previously unutilized material. Moreover, they emphasize that by making the removal of this low quality wood economically feasible, this could open up space in the forest for growing higher quality trees with proper management practices.

At the same time, others are concerned that, since clearcutting is the most economical method for harvesting wood for chips, and since most tree species are suitable for conversion to chips, landowners will be encouraged to liquidate stands for short-term financial gain at the expense of growing higher quality trees requiring longer rotations. The potential that higher quality trees that had previously served as resources for traditional wood products will now be processed into chips is one potentially adverse result of the above. Moreover, given landowners' reluctance to seek professional assistance in forest management, the potential environmental effects of increased clearcutting without management guidance to supply chip mills are also viewed with concern.

Uncertainty surrounding the above questions prompted Governor Carnahan to establish the Advisory Committee on Chip Mills to examine the potential environmental, economic and social effects of present and future mills on Missouri forests and the citizens of the state.

II. THEMATIC BACKGROUND

Part II of the report contains a variety of information concerning important aspects of the chip mill issue. It begins with an overview of timber resources in the state, examining such factors as timberland ownership, growing stock vs. nongrowing stock (cull) volume, and annual growth and removals. Section A also includes a set of scenarios which incorporates different potential levels of wood consumption by the two high capacity mills with overall growth and drain projections for the areas surrounding the two mills. Finally, it includes a brief look at the potential role of remote sensing and satellite imagery in understanding the status of Missouri forest resources.

Section B briefly examines the idea of sustainable forest management as a guiding criterion for the Committee's work. It then looks at how forest productivity and timber yields may be enhanced through forest management regimes, and how both even- and uneven-aged management regimes can be profitable for the private forest landowner if appropriate management strategies and practices are employed. The section concludes with a brief overview of possible management actions and outcomes in harvesting to meet demands for wood chips.

In Section C attention turns to current and potential social and economic impacts from chip mills in Missouri. The discussion begins with a look at several characteristics of an 'ideal hardwood market' for chips and its relationship to sustainable forest management. The process through which chip mills

obtain their wood is also reviewed. This is followed by a review of the potential economic impacts of the chip mills on the state's forest products and tourism industries. The focus then shifts to the different kinds of economic incentives available to private landowners and forest products firms to encourage sustainable forest management and timber production, These include fiscal and tax incentives for landowners as well as business incentives for forest products firms. The section concludes with a brief look at several kinds of institutional arrangements that have the potential to forge new linkages among the diverse participants in the state's forestry community.

Section D addresses the potential effects of chip mills and associated timber harvesting practices in Missouri on the array of ecosystem components, processes and functions that comprise the forest environment in the state. These include the possible effects of timber harvesting on soil fertility and erosion; water quality, sedimentation, and watershed protection; and biodiversity and species conservation. Potential impacts on the quality and availability of recreational opportunities, including those nonconsumptive uses involving the appreciation of the aesthetic amenities of the forested environment, are also briefly addressed. Finally, the nature and extent of standards and permits to ensure environmental sustainability are considered in the context of the chip mill issue in Missouri. This includes the definition and use of 'best management practices,' as well as the kinds of approaches that have been adopted in other states when addressing all of the above factors affecting impacts of timber harvesting on the sustainability of forest ecosystems.

In Section E the focus shifts to the forest landowners, loggers, and forestry professionals who are central actors in the status and management of Missouri forests, and who respond either economically or professionally to demands for wood by chip mills and other wood products firms in the state. The section begins with a brief overview of landowner motivations for harvesting timber from their lands, including factors related to length of tenure and proclivity to harvest. Attention then turns to the array of information and educational programs focused on nonindustrial private forest landowners in Missouri and to factors affecting program source, content, and delivery. This is followed by a review of efforts directed at the training of loggers in the state, and to the various forms of logger licensing that are potentially available for adoption in Missouri. The section concludes with a discussion of forester credentialing programs as a self-regulatory approach for strengthening the profession of forestry in the state.

The final three sections of Part II contain brief overviews of several additional topics important to the Committee's deliberations. Section F examines the question of landowner rights and responsibilities as an important underlying consideration in addressing not only the chip mill issue, but any aspect of natural resource and environmental policy in Missouri. This is followed by a summary of the conclusions of a 1997 internal study conducted by the Missouri Department of Conservation on the potential impacts of the two high capacity chip mills that have located in the state on Missouri forests and natural resources (Section G). Part II concludes with a brief overview of how the issue of high capacity chip mills has been addressed in several other states – Tennessee, Arkansas, North Carolina, and Virginia – either through formation of a deliberative body with functions similar to that of the Governor's Advisory Committee in Missouri or through studies commissioned to address the issue.

The Thematic Background represents a compilation of information on forests and forestry in Missouri upon which the Committee relied in discussing the variety of topics it considered in relation to the 'chip mill issue.' Its value, however, is not intended to disappear when the Committee has completed its task. Rather, it is intended as a foundation on which to draw and improve, in the process enhancing our understanding not only of the role of chip mills within the Missouri forest landscape, but of the significance of the state's forest lands and resources and their management as a central component of the quality of life for all Missourians.

III. ACTION AREAS

At its meeting in April 2000, the Committee reviewed more than 70 potential recommendations for actions that could be taken in addressing various aspects of the 'chip mill issue' in Missouri. A condensed listing of the 35 recommendations which were approved through a *majority* vote of Committee members is presented below.

A. ENVIRONMENTAL SUSTAINABILITY

1. Sustainable Forest Resources Act and Forest Resource Council

* Establish a Missouri Forest Resource Council with several specified functions.
* Update State Forestry Law: New incentives for participation linked to best management practices.

2. Ensuring Best Management practices (BMP's)

* Create an interagency task force to evaluate the present definition of "best management practices."
* Institute a requirement for use of best management practices for harvests involving removal of 50% or more of forest cover on more than 40 contiguous acres during a period of one year within Ozark regions. Establish a requirement for a Missouri Timber Harvest permit issued by MDC for such harvests.

3. Information Base

* Develop a data base about forest resources in Missouri similar to that of the U.S. Census of Agriculture.
* The Missouri General Assembly should fund :
  - A long-term research effort focused on the wood source area for chip mills that utilizes remote sensing and other techniques to investigate harvest sites, location, methods, and use of BMP's.
  - A comprehensive two-year study of the environmental, social and economic impacts associated with chip mills, including harvesting in source areas, to be comprised of university, state and federal agency personnel and submitted to the General Assembly by January 1, 2003.
* Support a system of voluntary harvest pre-notification to MDC to facilitate information dissemination to landowners and as a source of data on extent/type of timber harvests and use of BMP's on private lands.
* Support legislation to establish authority for determining characteristics of timber used by high capacity chip mills.

4. Other

* Encourage companies to use principles of certification programs (e.g., Sustainable Forestry Initiative) in harvesting timber on their lands, and to participate in a verification process.
* Assess fines on responsible parties based on environmental degradation their actions have caused.

B. EDUCATION, TRAINING AND PROFESSIONAL MANAGEMENT

5. Logger Training

* Support the existing logger training program in state, and create incentives for voluntary logger certification and the use of trained loggers in timber harvesting.
* Encourage formation of a coalition of forest landowners who would agree to use trained loggers.

6. Professional Foresters

* Establish a professional registry board for professional licensed foresters to practice in Missouri.

7. Landowner Education

* Conduct a comprehensive evaluation of all existing forest landowner education programs in Missouri.
* Establish an evaluation project to be conducted by MDC to analyze forest landowner education efforts.
* Institute a high intensity forest landowner education effort in the chip mill sourcing areas.
* Expand and aggressively market the existing Forest Cropland and Forest Stewardship programs.
* Establish an interagency working group with several specified functions to provide support to any future Missouri Forest Resource Council in matters related to landowner education & information distribution.
* Support an arrangement whereby UMC Extension experts, in conjunction with MDC foresters, provide silviculture courses throughout the state as part of a five-year intensive educational effort.
* Develop seminars to assist landowners in bidding and selling their standing timber.

C. SUSTAINABLE ECONOMIC AND SOCIAL IMPACTS

8. Economic and Social Impacts

* Endorse focusing incentives on those firms/industry segments that through expansion or diversification can provide substantial new jobs and enhance the value-adding process to primary timber products.
* Enhance efforts by state agencies to assist development of value-added forest products and export trade.
* MDED: work towards helping small/mid-sized value-added forest products firms expand/locate in state.
* Endorse a grant program for marketing/feasibility studies that provide assistance to wood products firms to develop value-added business concepts that lead to new or expanded uses or technologies for agricultural products and foster economic development in rural areas.
* Expand policies that encourage use of recovered paper by the paper industry and programs that require or promote the recovery of waste paper.
* Expand research & development of alternative fiber sources for paper, focusing on high-yield crops.
* Institute strategies that reduce the demand for virgin wood pulp, including policies that promote greater acceptance by the public and private sectors of lower grade paper stock in publications.
* Formally recognize the firm demonstrating outstanding performance in wood waste recovery at the annual Governor's Conference on Economic Development.
* Encourage the formation of forestry cooperatives for marketing, management, export development, etc.

D. FINANCIAL SUPPORT

9. Funding Sources for Policy and Program Development

* Support continued use of Conservation Sales Tax for funding to support for MDC's forestry programs.
* Consider using some of the revenues from the soil conservation portion of the Missouri Parks & Soils Sales Tax to sustain soil productivity for sustainable forest management & forest resources in Missouri.
* Special funding be provided by the Missouri Legislature to support study of the environmental, economic and social impacts of chip mills in the Missouri Ozarks.
* Encourage producers to develop a statewide check-off program on timber sales modeled after those for

other agricultural commodities. Revenue would support research, marketing initiatives, education, etc.

* Reduce tax liability for forest landowners who use sustainable management and BMP's by : a) Creating a sliding scale for capital gains tax; b) Allowing expensing of management costs; c) Allowing a double deduction for net cost of timber stand improvements; and d) working to reduce federal inheritance tax.

E. OTHER

* Recognize the fundamental rights and responsibilities of property owners relative to timber management through policies and land use practices that protect soil & water resources without unduly restricting landowners' discretion to make responsible land use decisions.

MDC : *Missouri Department of Conservation*
MDED : *Missouri Department of Economic Development*
UMC : *University of Missouri -- Columbia*

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I. INTRODUCTION

Forests are an important part of Missouri's natural landscape. Almost one-third of the state is covered by forest land, and two-thirds of the Eastern Ozark region of the state is forested. Forests are valued by Missourians for many reasons, including as a source of timber for wood products, as reservoirs for wildlife and sources of clean water, as destinations for tourists and settings for other recreational activities, as well as places for solitude and aesthetic appreciation. In a variety of ways, therefore, the forests of Missouri are an important resource for all citizens of the state.

Many people value forests as a source of raw materials to be made into a variety of products. Trees yield timber for products such as lumber and wood chips, which in turn may be made into an array of products such as furniture, flooring and paneling from lumber or pulp and paper from wood chips. Other wood products come from forest trees not ordinarily prized for timber production. These include such valued items as wood for carvings, baskets, novelties, and so on. Moreover, forests yield a variety of outputs in addition to wood products, including medicines from trees and plants, edibles in the form of mushrooms, wild berries, etc. In all of these ways, Missouri forests are valued for the direct *uses* that can be made of the raw materials they produce.

Missourians value their forestlands not only as a source of raw materials for products, but also in terms of the experiences they have in the course of interacting with the forest environment. Missouri's forests are home to a variety of mammals, fish, reptiles and amphibians, and plants, which people enjoy in many ways. Hunting and fishing for 'game' species provide countless hours of recreational enjoyment. At the same time, many Missourians enjoy 'non-consumptive' activities such as birdwatching, hiking and camping, canoeing, and the like, all of which reflect an underlying appreciation of the aesthetic value of the forest environment as an element of human experience. Even those who seldom if ever visit forestlands in the state may value the knowledge that they exist and are there to experience, not only for themselves or even all others alive today, but hopefully for their descendants as future citizens of the state as well. Finally, all of these ways in which the people of Missouri value their forest lands -- both as an environment within which to experience numerous amenities which make life interesting and as a source from which to gather materials useful for a wide range of products -- are becoming even more appreciated as we gradually come to better understand the unique place and functions our forests play within the complex ecological system of living and nonliving entities and processes that for generations we have experienced as the 'natural environment,' or more simply, 'Mother Nature.'

A few years ago a survey was conducted to try and better understand the attitudes of Missouri citizens towards the forest lands and resources of the state (Constance and Rikoon 1997). It was found that about nine in ten Missourians thought that careful harvesting of trees could actually be good for the forest in the long run. At the same time, a 1997 'Conservation Monitor' survey by the Gallup organization found that slightly more than one-half of Missourians approved of cutting trees to make lumber, furniture, and other wood products (Cited in Missouri Department of Conservation

1999a). In the former survey, almost two in five respondents indicated they had noticed activities in the forests which had concerned them. Moreover, while a similar percentage of respondents (39%) thought that forest management activities on private lands should be regulated by the state, slightly more (44%) thought that in general private forestlands in Missouri were being 'wisely managed.' Finally, only about 15% of private forestland owners indicated that they had received help from a professional forester in managing their lands. All of the above suggests a certain ambivalence among Missourians with respect to the management of, in particular, private forestlands in Missouri. This led the Missouri Department of Conservation (MDC) to conclude that with respect to the practice of forestry on nonindustrial private forestlands in the state, a dilemma existed -- i.e., a lack of willingness to address the problem of limited management guidance from a regulatory perspective and a lack of willingness by private forestland owners to ask for or accept management assistance from a professional forester (MDC 1999a).

It is within such a context that the 'chip mill issue' in Missouri emerged in the late 1990's. The following pages contain a variety of information relevant to different facets of this issue, as well as the conclusions and recommendations which resulted from extensive discussions by the Governor's Advisory Committee on Chip Mills.

The Issue of High Capacity Chip Mills in Missouri

Within the last few years Missouri has witnessed the arrival of two high-capacity chip mills in the southeastern part of the state.[1] Willamette Industries, located in Wayne County near Mill Spring, Missouri, and Canal Wood Corporation, situated within Scott County in Scott City, Missouri, are currently producing hardwood chips; and their combined expected output from normal operations (i.e., one shift) will be more than one-half million tons of chips per year. These firms expect to procure wood from within sixty to eighty miles of their mill sites. Timberlands account for about three-fifths of the land base within the area around Mill Spring and one-third of the area around Scott City, although not all of the latter area is within Missouri. A third chip mill is also operating in the state, although it is not a high capacity processing plant. Ozark Chip Company has been operating for some time in southwest Missouri, producing less than 100 thousand tons of chips per year from sawmill residue. It should also be noted that Westvaco Corporation does purchase approximately 200 thousand tons of wood per year in Missouri, three-quarters of which is chips purchased from sawmills.

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[1] Missouri has traditionally been home to a wood products industry comprised of many small mills producing lumber and a variety of related products. As noted by the Missouri Department of Conservation (1999a) a chip mill producing 300 thousand tons of chips per year provides a sharp contrast to a typical Missouri lumber-producing sawmill capable of producing in the vicinity of 24 to 32 thousand tons per year. The concept of "high capacity" is, however, a relative one. In some eastern states, for example, a chip mill producing the above volume of chips would not be viewed in these terms. Nonetheless, the chip mills that have located in Missouri undoubtedly provided a stark contrast to the levels of wood processing volumes traditionally seen in the state. To reflect this historical context, we may define a **high capacity chip mill** as a chip mill that produces more than 150,000 tons of wood chips per year as its principal output.

On a statewide basis, almost 85 per cent of Missouri forest lands are controlled by more than 300 thousand nonindustrial private forestland owners. Moreover, between 70 and 80 percent of lands within the aforementioned source areas surrounding the two high capacity chip mills are privately owned. Thus it is evident that the majority of wood that will be procured by these mills will come from nonindustrial private forestlands.

Pulpwood harvested for a chip mill can be generated in several ways. Pulpwood has generally been regarded as low quality material that in the past has either been left behind in the woods because loggers had no incentive to remove it or harvested and sent to pallet or blocking mills. In this light, some view chip mills as an opportunity to market low quality trees and ultimately provide space in the forest for growing high quality trees in the future. Others, however, are concerned that demands generated by chip mills will encourage irresponsible harvesting or liquidation of stands for short-term financial gain to the detriment of long-term sustainable forest management and, depending on how practices are conducted, ecological sustainability. These latter concerns are enhanced by current estimates that at present only 10-15% of all private forestland owners in the state have been seeking any professional advice or assistance when harvesting timber from their lands.

All of the above suggests an intricate relationship between demands for chips generated by the mills and practices conducted on nonindustrial private forestlands. The ultimate impacts of high capacity chip mills on long-term ecological and economic sustainability of Missouri forests depend in large part on the quality of forest management they encourage (or discourage) by forestland owners in the state. In this sense, the chip mill 'issue' is closely linked to the broader issue of the management of Missouri's nonindustrial private forestlands in general.

Governor's Advisory Committee on Chip Mills

In response to uncertainty regarding the potential short- and long-term impacts of high capacity chip mills on the ecological and economic sustainability of Missouri forests, Governor Mel Carnahan issued an Executive Order on September 18,1998 which, among other things, established an Advisory Committee on Chip Mills. The Order is comprised of a justification for the Executive action, the establishment of the Advisory Committee, and a description and its purposes and specific charges.

Such orders generally begin with a series of 'whereas' clauses justifying the Governor's taking this action. For this order, such clauses include :

a) a definition of a *chip mill* as the central focus of the order; and several reasons for its promulgation, including statements that:
b) Forest resources are vital to Missouri citizens.
c) The state supports forest-based economic enterprises.
d) Best management practices on Missouri forests are in the public interest.
e) There have been concerns voiced in other states about adverse environmental impacts from chip mills.

f) Chip mills in Missouri have led to citizen concerns.

In light of the above, the order established a *Governor's Advisory Committee on Chip Mills* to be comprised of the following members:

a) Four state departmental directors or their designees : Department of Conservation; Department of Natural Resources; Department of Agriculture; Department of Economic Development;
b) Four state legislators appointed by leadership of the respective chambers : 2 state senators and 2 state representatives ;
c) Two forest products representatives;
d) Two representatives from citizen conservation groups;
e) One representative from an organization representing private property owners; and
f) A forest landowner.

The Committee was to operate on a very modest budget of approximately $25,000 pooled from among the participating agencies.

The Executive Order also mandated that the Advisory Committee undertake a study to identify the impact of chip mills and associated harvest practices on the ecological and economic sustainability of Missouri forest resources. The study was to include, but not be limited to, an analysis of the experiences of other regions of the country with chip mills and related harvesting practices; as well as the economic, social, and environmental impacts of existing and new chip mills in Missouri and neighboring states -- including potential environmental impacts related to soil erosion, sedimentation, water quality & watershed protection, habitat loss, biodiversity, and outdoor recreation & tourism. Other required foci of the study included the sustainability of Missouri's forest resources under current timber production levels and the capacity of those resources to sustain increased chip mill production levels, as well as a consideration of the impact of chip mills on value added industries and high-value forest products. Finally, the study was to include an analysis of the long term profitability of private forests and it was to address alternative forest resource management and protection standards.

On November 24, 1999, the Governor issued Executive Order 99-11, extending the expiration date for the Advisory Committee on Chip Mills to February 1, 2000. This would ensure adequate time for public review of the Committee's Draft Final Report. On January 20, 2000, the Governor issued Executive Order 00-01, which extended the life of the Advisory Committee for however long it took to complete its work. Included in this third mandate were instructions for the Committee to review and incorporate in their analysis an internal report on the chip mill issue in Missouri that had been completed by the staff of the Missouri Department of Conservation in December, 1998.

Overall Process and Groups Involved

In carrying out its mandate, the Advisory Committee held a series of monthly hearings beginning in November 1998 and extending through July 2000. From November '98 to August '99 the Committee focused on gathering facts pertinent to the issue. The Committee heard 21 formal presentations during that time from a variety of sources. Each meeting also included an extensive period allotted to public comments. The June '99 meeting was conducted in conjunction with a field trip to Southeast Missouri on which the Committee visited several sites exemplifying different kinds and qualities of forest management practices.

Field trip (June 1999). The field trip was a learning experience for all who participated. The Committee looked at several examples of both even-aged and uneven-aged management. With respect to the former, it visited a 45 acre site that had been harvested by Westvaco Corporation as part of its cooperative forest management program with private landowners. The site had been characterized by three age classes of oaks in a fully stocked stand with low tree quality and a slow growth rate. Committee members saw how such a stand can be regenerated by cutting all trees down to a 2" diameter, where all regeneration comes from seedling sprouts and stump sprouts. In this case, even-aged management was utilized to generate a faster growing stand of high quality, with approximately the same species composition, yielding approximately the same size sawtimber as the current stand, but in 60 to 65, as opposed to 75-90 years.

The Committee visited a second tract owned by a private landowner on which a timber sale had been conducted as part of a Forestry Stewardship Plan that was prepared by the Missouri Department of Conservation (MDC). The landowner wished to generate income, improve the diversity of wildlife habitat, and create favorable conditions for increasing the amount of pine in the future forest. The sale consisted of 81 acres divided among six stands. A regeneration cut was applied, meaning that all merchantable trees were cut and removed and all the remaining trees were cut and left on the ground. When the sale had first been put out for bid in 1997, before a viable market for pulpwood had existed in the area, the high bid had been about $8500, well below the MDC estimate of the value of the timber. In March, 1998, with the opportunity to generate pulpwood as additional production, the high bid received was $26,970. This provided another example where even-aged management was being used to meet a variety of landowner objectives, including revenue generation, while the use of best management practices and other activities (e.g., reserving riparian corridors) were employed to further other objectives related to maintaining environmental sustainability.

The Committee also visited another 300 acre tract owned by an individual who lived in St. Louis and had contracted with one of the two high capacity chip mills to have the tract logged for chips. Severe rutting from the skidder used by the loggers was evident. Dwyer (1999) later described other aspects of the condition of the site at that time. Since the roads had been wet during part of the operation, much of the soil that was on the roadbed had been pushed up onto the landscape. Some small draws and ravines had been used to skid logs down, as opposed to pulling logs out of these areas via yarding or cabling. Adequate skid trails and log landings were lacking, and the latter had been located too close to the creek. Logs had been left on the site that were cut and not skidded. In short, there was

little evidence that best management practices (BMP's) had been employed in the harvesting of this site, and the resultant potential for future problems, especially in terms of water runoff, was evident. The absentee landowner also currently owns several other tracts totaling about 800 acres, which he plans to harvest and then sell. The 300-acre site visited by the Committee is also up for sale.

Finally, the Committee also visited two sites on which uneven-aged management had been utilized as the primary timber management regime. The first was a 160-acre tract owned by Emily Firebaugh, a member of the Governor's Committee. It had been under professional management for many years. Here group selection was being practiced -- the goal being to harvest big trees, but also to take out some 12-14" trees immediately surrounding prime harvest trees. In 1982, the owner had cut 167 thousand board feet of timber, removing almost 2000 growing stock trees and an equal number of culls, yielding a profit of $49 per acre of stumpage. Six years later, the owner cut 61 thousand board feet of timber, removing 390 growing stock trees and 27 culls, and realizing a profit of $180 per acre of stumpage. It was evident that uneven-aged management had the potential to be profitable for the owner, while maintaining the forest canopy contributed to the realization of other nontimber forest benefits as well.

A second example of uneven-aged management was viewed by the Committee at its final stop at a tract being managed by Pioneer Forest. The goal of uneven-aged management as practiced by Pioneer is to utilize selective harvesting to create openings, grow high quality hardwoods, and as openings close up, come back in to the stand in 18- 25 years and harvest again. Pioneer removes about 1/3 of standing volume and 30% of trees in a given harvesting operation. In so doing, it can in principle take a stand in poor condition, go through with improvement cuttings, harvest in 25 years and then in another 25 years, and have created an uneven-aged stand of four age classes.

Pioneer's strategy focuses on the relationship between a given species and the site on which it is growing. It prefers to take out between one-quarter and one-third of annual growth through an uneven-aged management regime which, on the site visited by the Committee, amounted to a net after-harvest of 135 board feet per acre per year. Another objective is to manage irregular natural gaps in the forest to lead to more than enough natural regeneration to perpetuate the system.

The field trip was a rewarding experience for Committee members and others who participated. It provided a concrete reference for on-the-ground forest management activities to which members could relate during the subsequent weeks of discussion regarding the variety of facets involved in the 'chip mill issue' in Missouri.

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Part of the Committee meetings in July and August of 1999 were devoted to beginning the decision process described below. In September, the Committee began its discussion and debate of various potential actions it might take in carrying out its assigned tasks. These discussions continued over the next six months. The public comment periods were continued throughout this entire process. In April, 2000, votes were taken on approximately 70 different potential options for actions in addressing the chip mill issue.

Input to the Committee was obtained from a variety of individuals and group representatives. These included actors involved in the central process of wood flows from private forest lands to the chip mills -- i.e., private forest landowners, loggers, and representatives of the chip mills and other wood products firms. In addition, those indirectly involved in this central process -- i.e, professional foresters, natural resource (and other) agency representatives, and scientists and technology transfer professionals -- also provided input to the Committee. Finally, representatives from groups that had particular economic, environmental, and political interests in the key issues involved were also important sources of information for the Committee. The Committee heard testimony -- both in formal presentations and via the public comment process -- from all of these actors.

Committee Decision Process

The process through which the Committee moved towards decisions in response to its tasks as spelled out in the Governor's Executive Order began in earnest during the July and August meetings in 1999. As a first step, the Committee was asked to envision the kind of outcomes it would like to see have resulted from its work when viewed twenty years from now -- i.e., in the year 2019. Members of the Committee identified 24 possible outcomes that, if viewed in retrospect twenty years from now, they would like to see have resulted from the Committee's work in 1999.

The group was then asked to organize those 24 outcomes, several of which were interrelated and/or overlapped to varying degrees, into a smaller number of themes or thematic areas. Seven themes were identified through this process : landowner education & logger training; professional management; sustainably managed resources; increased timberland resource base; sustainable social & economic impacts; environmental sustainability; and landowner rights and responsibilities.

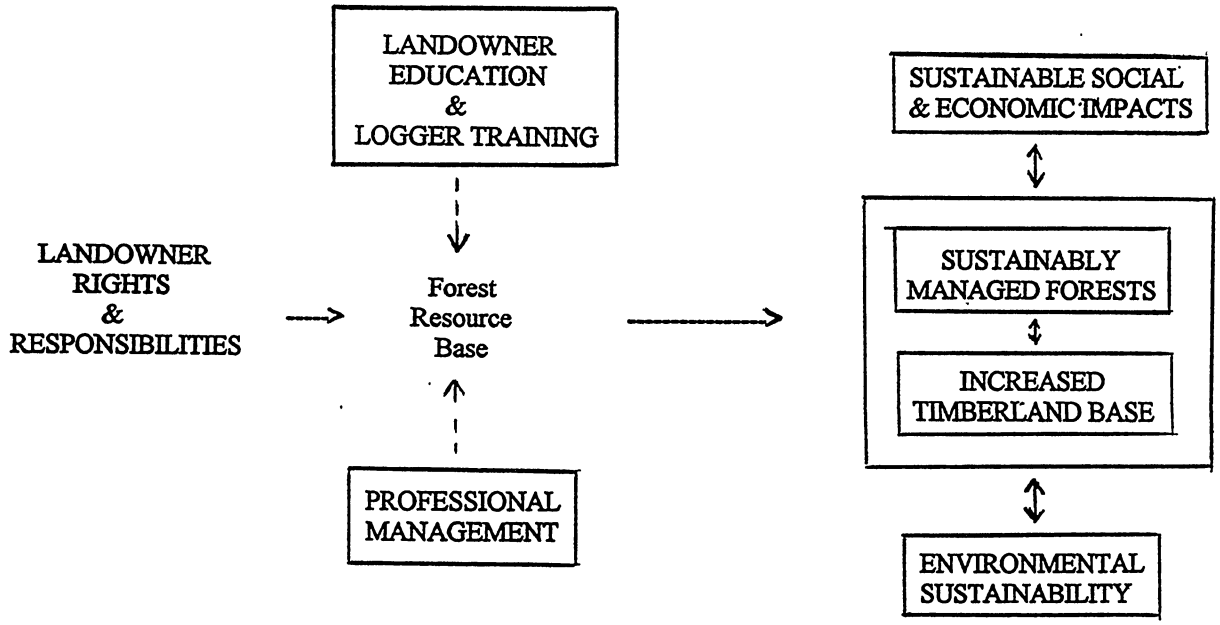
These thematic areas then served as a basis for the generation of proposals and/or possible courses of action by Committee members that would address its required tasks. Subsequent discussion and debates centered on ideas generated from this conceptual format. Part II of the report contains a compilation of background information on each of these areas. The conclusions and recommendations of the Governor's Advisory Committee on Chip Mills are presented in Part III.

II. THEMATIC BACKGROUND

The Committee defined its purpose as encouraging the sustainability of Missouri forests and forestry practices. Then, as a way of organizing their work, Committee members formulated a vision of what the future would be like if that purpose were actually achieved. From that vision, several themes were identified, and these form the basis for the organization of this part of the report. Those themes are:

a. Sustainable Timberland Resource Base
b. Sustainably Managed Forests
c. Sustainable Social and Economic Impacts
d. Environmental Sustainability
e. Education, Training and Professional Management
f. Landowner Rights and Responsibilities

The *Thematic Background* is organized according to the above themes. Two additional sections are also included in this part. The first briefly describes the conclusions and recommendations of an internal study on the 'chip mill issue' completed by the Missouri Department of Conservation in December, 1998. The final section presents a brief overview of experiences with the 'chip mill issue' in other states. The following diagram illustrates the relationship of these central themes to the basic purpose of encouraging sustainable forests and forest management in Missouri.



A. SUSTAINABLE TIMBERLAND RESOURCE BASE

Timber Resource Setting[2]

On an overall basis, slightly less than one-third of Missouri -- some 14 million acres -- is covered by forest land (Table 1). Almost 96% of that area, or about 13.4 million acres, is classified as timberland.[3] About 15% of this area is public land, most of which is administered by either the U.S. Forest Service or the Missouri Department of Conservation. Forest industry owns only 2% of the state's timberland area. The vast majority of these lands -- some 83% or 11.1 million acres -- is controlled by nonindustrial private forestland (NIPF) owners.[4] The number of such owners in Missouri has increased dramatically over the past two decades, from about 81,000 in 1978 to 307,000 in 1994 (Birch 1996a).

Many of these individuals or groups own relatively small acreages. In Missouri, 48% of NIPF owners have tracts of less than 10 acres, and 79% own tracts of less than 50 acres in size (Table 2). On the other hand, when viewed from the perspective of size of holdings (as opposed to number of owners), 57% of the NIPF acres owned are in tracts of 100 acres or more, and 77% are in tracts of 50 acres or more. Thus much of the acreage is in larger tracts, while most of the owners own small tracts.

The most recent estimates of NIPF ownership turnover rates suggests that the average turnover rate for a given NIPF acre is every 28 years.[5] One assumption that was adopted in the following analysis of growth and drain projections from Missouri forests is that an acreage equivalent to most of the NIPF parcels in the state will change ownership within the next 50 years. When extending that assumption to the notion of present and future timber availability in the state, this implies that an

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[2] Unless otherwise noted, the primary source of information for this subsection "Resource Setting" and the following two subsections "Timber Growth and Drain" and "Alternative Scenarios....." is Shifley (1999a ; 1999b; 2000).

[3] **Timberland** -- formally called commercial forest land -- is defined as forest land that is producing, or is capable of producing, more than 20 cubic feet per acre per year of industrial wood crops under natural conditions, and that is not withdrawn from timber use by statute or administrative regulation or associated with urban or rural development. Currently inaccessible and inoperable areas are included in this definition (Shifley 1999a).

[4] Within this NIPF category, 7% of the state's timberlands are owned by corporate entities other than forest industry. Thus approximately 76% of Missouri timberlands are owned by farmers or other private individuals (Table 1).

[5] Calculations were performed by Shifley (1999; derived from Birch, 1996b). This period is substantially longer than the 'folk knowledge' figure of 7 years for the average turnover rate for NIPF landholdings that was cited frequently during the course of the hearings conducted by the Governor's Advisory Committee.

Table 1. Missouri forest resource and Missouri timberland by ownership
(Source: Hahn & Spencer 1991)

A. Missouri Forest Resource (1989)
(millions of acres)

Total Land	44.1
Total Forest	14.0
Total Timberland	13.4

B. Timberland by Ownership (1989)

	(thousand acres)	%
National Forest	1321	10.0
Other federal	246	2.0
State	403	3.0
County	42	< 1.0
Industry	222	1.7
Other Corporate	929	7.0
Farmer	5024	37.6
Miscellaneous Private Individual	5184	38.8
	Total : 13371	

acreage equivalent to the total acres of NIPF lands in Missouri could potentially be available for timber harvest during that time.

When considering the two existing high-capacity chip mills in Missouri, the area of potential impact shifts from the above statewide focus to a smaller region in southeastern part of the state. For each of these operations, it is economically feasible to procure wood from within a 60-mile radius of the mill site (Figure 1).[6] Thus it is this combined area, some of which is overlapping, in which the impacts of the chip mills on the state's timberland resources will be experienced. With respect to the Willamette facility at Mill Spring, about 3/5 of the area within a 60-mile radius of the mill is timberland, and 73% of that land is under NIPF ownership, with the rest under federal (22%) and

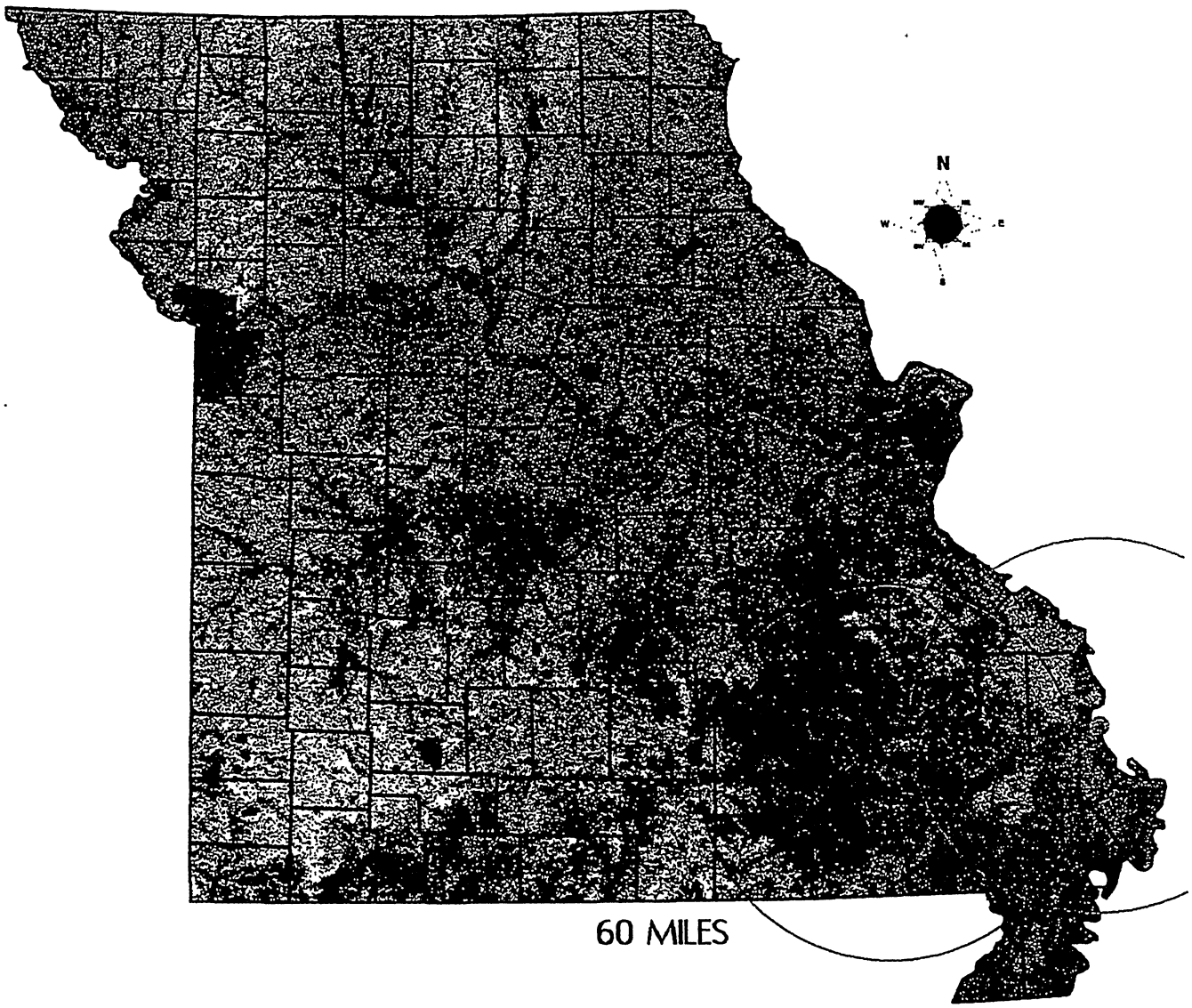
[6] Throughout most of the period during which the Committee held hearings, it was assumed that the radius defining the source areas for both mills was 60 miles. In November, a representative of Canal Industries informed the Committee that Canal actually acquires wood from lands within an *80* mile radius of the Scott City facility. The discussion which follows in Part A is based on the 60-mile radius assumption. The analysis should eventually be re-done to reflect the larger radius for the Scott City mill's wood procurement area.

Table 2. Estimated number of ownership units and acres of forest land, by size class and form of ownership, Missouri, 1993. (Source: Birch 1996)

Size class (acres)	Ownership class						Total
	Individual	Percent	Corporation	Percent	Other	Percent	
			(In owners)				
1-9	146,400	48	0	0	0	0	146,400
10-19	48,500	16	0	0	0	0	48,500
20-49	46,400	15	0	0	2,000	53	48,400
50-99	33,000	11	0	0	1,000	27	34,000
100-199	17,900	6	0	0	0	0	17,900
200-499	9,200	3	300	38	600	16	10,100
500-999	1,100	W	500	57	0	0	1,500
1000-4999	200	W	0	0	100	3	400
5000+	W	W	W	5	W	W	100
Sub total over 10	156,300	52	800	100	3,800	100	160,800
Total	302,600	100	800	100	3,800	100	307,200
			(In thousands of acres)				
1-9	302	3	0	0	0	0	302
10-19	604	6	0	0	0	0	604
20-49	1,359	13	0	0	50	8	1,409
50-99	2,114	20	0	0	50	8	2,164
100-199	2,416	23	0	0	0	0	2,416
200-499	2,517	24	101	17	151	25	2,768
500-999	654	6	252	42	0	0	906
1000-4999	302	3	0	0	151	25	453
5000+	154	1	252	42	201	33	607
Subtotal over 10	10,120	97	604	100	604	100	11,328
Total	10,422	100	604	100	604	100	11,630

W- Fewer than 50 owners or less than 0.5 percent.

FOREST COVER IN MISSOURI WITH POTENTIAL CHIP MILL HARVEST ZONES



DECIDUOUS FOREST
CONIFEROUS FOREST
GRASSLAND
CROPLAND
URBAN/DEVELOPED
WATER

state (5%) control. For the Canal Industries facility at Scott City, slightly less than 1/3 of the land base within a 60-mile radius of the mill site is timberland; and 81% of these lands are under NIPF ownership, with the rest administered by federal (15%) and state (4%) agencies. It should also be noted only 51% of all lands within the 60-mile radius of the Scott City mill are in Missouri..

Timber Growth and Harvest

The primary source of information on the status of Missouri's forest resources in terms of land area, volume of standing trees, and rates of timber growth and harvesting is the periodic inventory conducted by the U.S. Forest Service, in cooperation with the Missouri Department of Conservation. Data is analyzed through the USFS's Forest Inventory and Analysis (FIA) program at the North Central Forest Experiment Station located at St. Paul, MN. For Missouri, the two most recent comprehensive forest inventories were completed in 1972 and 1989, respectively. A new statewide inventory of forest resources is underway and will be completed in 2003. This inventory utilizes a new process that will sample approximately 20% of the forest land in Missouri on a continuing basis. However, at present it will be several years until results comparable to those from the 1989 inventory are available for the area around the chip mills. This obviously complicates the task of understanding current and potential impacts of chip mills in Missouri since, among other things, the two high-capacity mills currently operating did not arrive in the state until the late1990's. Their impacts, therefore, along with the impacts of any future mills, can at present only be addressed through the use of inferences based on existing inventory data. This is addressed further below.

When focusing on the quality of Missouri's forest resources for wood production, it is helpful to differentiate these resources into two broad categories -- growing stock and non-growing stock, often referred to as cull. ***Growing stock*** trees are live trees of commercial species that meet specified standards of size, quality, and merchantability. Noncommercial species, rough, and rotten trees are excluded from this category.[7] The growing stock volume in Missouri's forests in 1989 was 9 billion cubic feet. In addition to this amount, the state's forests also contain 4.8 billion cubic feet of trees (or portions thereof) that are non-growing stock because of rot, form, or other defects. This non-growing stock volume has traditionally been termed ***cull material***, because it is unusable for lumber

[7] In addition to trees that are classified as growing stock, and those which are classified as noncommercial species, two other kinds of trees are specifically defined with the Forest service's FIA program. **Rough trees** are: (a) live trees of commercial species that do not contain at least one merchantable 12-foot sawlog or two sawlogs 8-feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of roughness or poor form; and (b) all live trees of noncommercial species. **Rotten trees** are live trees of commercial species that do not contain at least one merchantable 12-foot sawlog or two sawlogs 8-feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50% of the cull volume in a tree is rotten (Spencer et al. 1992).

Table 3. Total and per acre volume of growing stock and cull by ownership, Missouri, 1989 (Source: Hahn & Spencer 1991)

	Public	Forest Industry	Private	Forest Industry and Private
Total acres	2,011,900	222,400	11,136,500	11,358,900
Total growing stock (1000 cu.ft.)	1,656,170	172,669	7,136,434	7,309,103
Total rough cull (1000 cu.ft.)	484,868	43,025	3,576,105	3,619,130
Total rotten cull (1000 cu.ft.)	105,483	16,120	620,091	636,211

	Public	Forest Industry	Private	Forest Industry and Private
Total acres	2,011,900	222,400	11,136,500	11,358,900
Mean growing stock vol.(cu.ft./ac)	823	776	641	643
Mean rough cull vol. (cu.ft./ac)	241	193	321	319
Mean rotten cull vol. (cu.ft./ac)	52	72	56	56
Mean rough & rotten cull vol.(cu.ft./ac)	293	266	377	375
Rough cull (% of Growing stock)	29	25	50	50
Rotten cull (% of Growing stock)	6	9	9	9
Total cull (% of Growing stock)	36	34	59	58

production;[8] and it accounts for about 35% of the total standing volume in Missouri forests, with growing stock accounting for the other 65%. Both in total volume and as a percent of standing volume, this cull material exceeds that of any other state in the nation. Moreover, the total volume of cull trees on nonindustrial private lands in the state is more than six times greater than the total cull volume for all other ownerships (i.e., federal, state, industry) combined (Table 3).

[8] The technical definition for **cull material** is "portions of a tree that are unusable for industrial wood products because of rot, form, or other defect (Spencer et al. 1992). In practice, a tree may be classified as a 'rough tree' or a 'rotten tree,' and these in turn grouped into a single non-growing stock category called 'cull.' Thus in the definition of terms for the Southern Research Station Forest Inventory & Analysis Program (which provided the guidelines for the Missouri Forest Survey was conducted), **cull** is defined as "net volume of rough and rotten trees plus the nongrowing stock portions of growing stock trees (http://srsfia.usfs.msstate.edu/rpa/tpo/definitions/htm). This tree-based classification is commonly used to highlight the basic distinction between growing stock trees (potentially suitable for sawtimber)and other non-growing stock trees. There are, however, categories of cull trees (as classified above) that *are* usable for wood products other than timber. In fact, it has been estimated that on a statewide basis some 16 million cubic feet of cull trees are harvested for wood products annually (e.g., ties, pallets, etc.) (Piva et al. 1997).

A number of factors contribute to the above situation. Among the most significant is the combined effect of the relatively poor site quality of much of the Ozark forestlands and the cultural attitudes fostered over the years that led to 'highgrading' -- i.e., harvesting only the best quality trees and ignoring other factors such as stand structure and composition -- influenced in part by the lack of a market for low-grade materials. Nonetheless, while cull material has no current or potential market value for sawtimber, it can and does serve as raw material for other kinds of wood products such as railroad ties, pallets, novelties, etc. Missouri's forest industries have traditionally produced marketable products from wood by-products such as slabs, edgings and sawdust for charcoal, and bolts (four-foot sections with small-end diameters of greater than six inches) and re-sawed slabs for pallet stock Trees containing only one 8-foot sawlog, post or bolt are considered harvestable, which implies that at least 95% of the volume (65% in growing stock and 30% in rough trees) found growing on an average acre of timberland in Missouri in 1989 could be utilized for commercial products (Law 2000). Of particular interest here is that chip mills are capable of utilizing this low quality material for processing into inputs for pulp and paper operations. At the same time, while these mills constitute a potentially viable market for cull material, this does not imply that the mere potential for such a market is necessarily related to the kinds of forest practices undertaken to supply that market.

When considering timber growth and drain in the aforementioned areas impacted by the two chip mills, the figures in the top part of Table 4 depict the annualized difference between growth and removals of *growing stock* in the chip mill source areas. In the Mill Spring area, annual growth and removals totaled 96 and 49 million cubic feet, respectively, leaving a net annual growth of 48 million cubic feet. For the Scott City mill's source area, annual growth and removals totaled 63 million and 38 million cubic feet, respectively, yielding a net annual growth of 25 million cubic feet. Thus when considering the growing stock volume on all timberlands in both mill sourcing areas (taken individually), there existed a substantial excess of growth over removals between 1972 and 1989.

These figures have been adjusted, however, to more accurately reflect growing stock on timberlands that are actually accessible and otherwise available for marketable wood products (Shifley 1999a). In this analysis, two basic adjustments were applied to the net annual growth figures for each source area. First, the net annual growth figures were reduced by 45% to account for four factors that are presumed to significantly affect actual timber availability for chipping : a) the presence of species unsuitable for chipping, such as conifers, hickory, blackjack oak, etc.; b) slopes of greater than 40% grade; c) acres dedicated to riparian and road buffers; and d) all public lands within the two mill sourcing areas. In this latter regard, it was assumed that while both federal and state public lands are dedicated to sustained yield management of all resources, including timber, many resource outputs produced from these lands are not market driven. Secondly, the growing stock available for harvest remaining after this first set of adjustments was further reduced by 16% to avoid double-counting growing stock volumes in the area where the Mill Spring and Scott City sourcing areas overlap (Figure 1). The overall results for adjusted net annual growth of growing stock in each of the sourcing areas as of 1989 are 22 million cubic feet and 13 million cubic feet for Mill Spring and Scott City, respectively.

Table 4. Relevant data on annual growth, removals, net annual growth, and expected impact of chip mills on annual harvest levels. Missouri: 1972-1989. (Source : Shifley 1999a ; 2000)

	Growing Stock (cubic feet)		
	Missouri	Mill Spring Area	Scott City Area
Growing stock volume	9 billion	3 billion	2 billion
Annual growth	267 million	96 million	63 million
Annual removals	117 million	49 million	38 million
Net annual growth	150 million	48 million	25 million
Adjusted net annual growth[a]		22 million	13 million
Projected annual removal for chips		6.7 million	11.7 million
Annual harvest from growing stock required to meet chip mill and other demand		56 million	50 million
Increase in current annual growing stock harvest to meet chip mill demand	16%	14%	31%

	Cull Material (Non growing stock) (cubic feet))	
	Mill Spring Area	Scott City Area
Current cull volume	1026 million	517 million
Adjusted available cull volume[a]	474 million	265 million
Projected annual removal for chips	6.7 million	11.7 million
Estimated supply of chips from cull at anticipated rate of utilization	71 years	23 years

[a] Adjustments to net annual growth and cull volume involve 2 stages : 1) a 45% (Mill Spring) or 39% (Scott City) reduction for unusable species, riparian and road buffers, slopes greater than 40%, and public lands, which are assumed to be dedicated primarily to non-timber uses (although timber production is not presumed to be categorically excluded); and b) a further reduction of 16% (from the above adjusted figures) for source area overlap.

When comparing the above figures for adjusted net annual growth in the two source areas to the anticipated wood utilization of the two mills, the following picture emerges. For the Mill Spring facility, projected production at average capacity[9] will require about 200,000 tons (6.7 million cubic feet) of wood per year at the gate. The Scott City facility will require 350,000 tons (11.7 million cubic feet) per year (again noting that not all of the source area for this mill is in Missouri). When relating adjusted net annual growth of growing stock and anticipated wood demands by the mills, it is evident from Table 4 that, for the Mill Spring area, to supply the 200,00 tons projected demand for wood exclusively from growing stock, annual harvest will increase by 14%, from 49 to 56 million cubic feet. To supply the Scott City facility with its expected annual demand of 350,000 tons of wood, again with the entire source being growing stock, annual harvest in its source area will have to increase by 31%, from 38 to 50 million cubic feet.

The lower portion of Table 4 presents an overview of the estimated available volume of cull material, or equivalently, non-growing stock in the source areas (i.e., within a 60-mile radius) of the chip mills at Mill Spring and Scott City. As noted earlier, cull material is not suitable for sawtimber products and thus not accounted for as part of the growing stock. Estimated available cull volumes, after adjusting total volumes in the same manner as was applied to annual growth (Table 4), are 14.2 and 7.9 million tons for the Mill Spring and Scott City source areas, respectively. At the expected rate of wood utilization by the mills, this translates into a 71-year supply of chips for the Mill Spring facility and a 23-year supply for the Scott City mill. Although all of this available cull volume will certainly not be harvested, these figures do suggest that there is a significant amount of low quality wood resource in the vicinity of the two mills to supply their expected demands for wood for at least two decades, in the case of the Scott City Mill, and substantially longer for the Mill Spring facility. The extent to which such resources will actually be utilized by the chip mills is a separate question which the above figures are not intended to answer.

Additional Scenarios for Projecting Growth and Drain

The above methodology provides an analysis of the impacts of Missouri's two high capacity chip mills on timber resources in the source areas surrounding the mill sites (Shifley 1999a ; 2000). Given that the next comprehensive statewide forest inventory will not be completed for several years, additional analyses were conducted which included a series of scenarios projecting wood utilization by the two chip mills and impacts on growing stock in the source areas over the next several decades (Shifley 1999b ; 2000). One set of scenarios was based on the above 'baseline' analysis of 1989 inventory data, to which additional more restrictive assumptions regarding wood availability were applied. A second set of scenarios, covering the period from 1989 to 2030, was based on both the 1989

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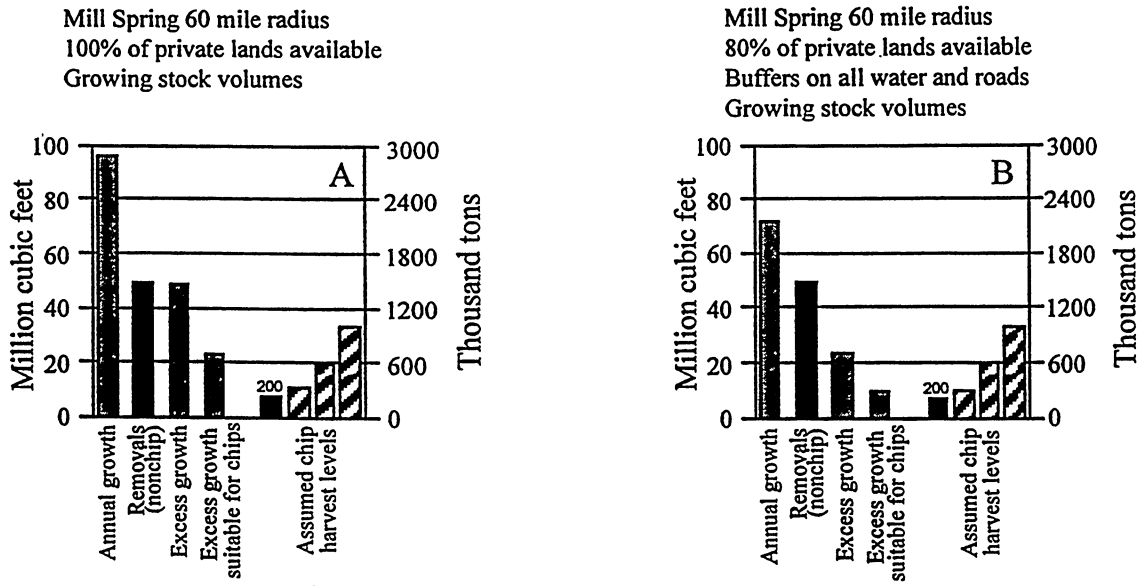
[9] Previously the term "full capacity" has often been substituted for this term, resulting in some confusion surrounding the concept. In keeping with the conventional terminology in most industries, *full capacity* has been used to designate the use of an entire physical facility with a full labor contingent -- that is, "round the clock" production (and thus three shifts) with a full labor component. That usage will be adopted here. Thus *average capacity* refers to one shift working a 40-hour week. Any overtime hours thus exceed average capacity.

statewide inventory data, and on periodic data on wood products production in Missouri.

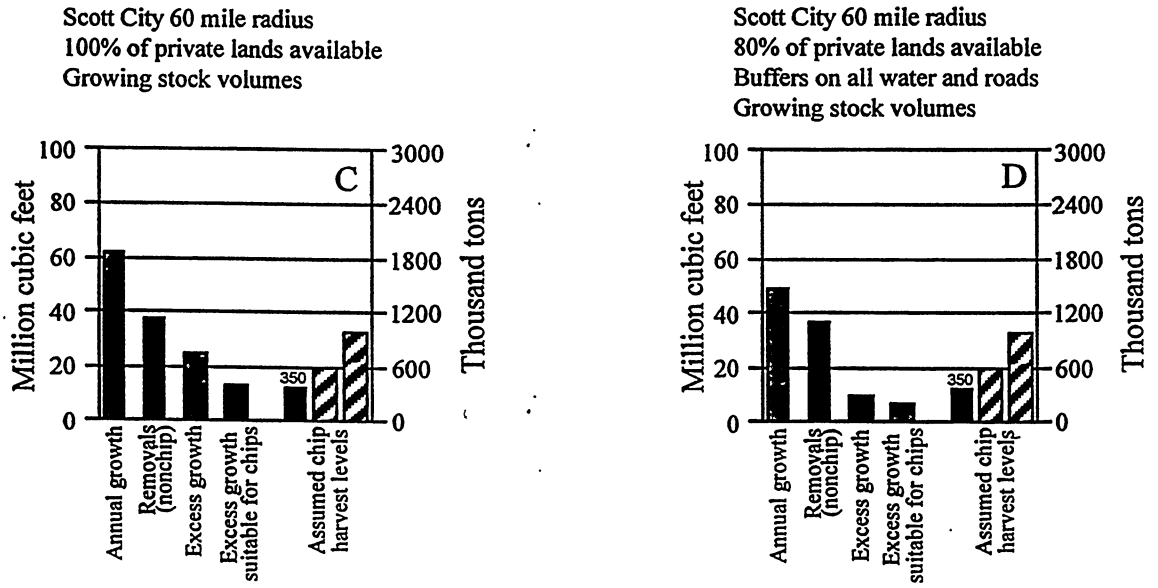
Alternative Scenarios Based on 1989 Statewide Inventory Data. The first part of this supplementary analysis employed the same methodology for assessing timber supply in the mill source areas as described above. These scenarios examined how results from the baseline analysis would differ if there were: a) increasing wood demands and associated harvest levels generated by the chip mills; and b) a reduction in the volume of wood available to the mills due to landowner unwillingness to sell timber. Scenarios with this latter assumption also included an increase in total land in buffer areas to include all streams and roads, a certain aggregate percentage of which had been assumed in the baseline analysis to be without buffers (Shifley 2000).

One set of scenarios started with the baseline analysis described above and incorporated potential increases in the demand for wood chips by the two mills (Figures 2a and 2c; Appendix tables A1-A4). Annual chip demand levels for the Mill Spring facility were increased from 200 to 350, 600, and 1000 thousand tons; and Scott City demand levels were increased from 350 to 600 and 1000 thousand tons. The 5% volume reduction for stream buffers was also included in each of these scenarios. As in the baseline analysis, results of these additional assumptions may be interpreted both for situations where the entire supply of chips is obtained from growing stock (Figures 2a-2d) and for where it is derived exclusively from cull material (included in Appendix A tables). For growing stock, the differences from using these additional assumptions would be manifest in the amount of growing stock remaining after demands for both chips and other wood products were satisfied. In Figures 2a-2d, this 'residual' annual net growth is the difference between "excess growth available for chips" and "assumed chip harvest levels." For cull material, the difference produced by incorporating the scenario assumptions is depicted in the final row of Appendix tables A-1 - A4 as 'equivalent supply for chip harvest.' (This is also identical to the last entry in Table 4 : 'estimated supply of chips from cull at anticipated rate of utilization.')

Not surprisingly, the results of this set of scenarios indicate that as utilization of chips by the two mills increases, the 'residual' annual net growth in growing stock in the source areas declines. The scenarios provide a picture of *how* adjusted net growth (i.e., excess growth available for chips - chip removals) declines with different rates of wood utilization by the chip mills. Thus, for example, in translating the graphics of Figure 2a into numbers (see tables A1-A4), when projected annual removals for chips are increased from 200 thousand to 600 thousand tons for the Mill Spring area, the residual net annual growth suitable for chips declines from 436 to 36 thousand tons. Similarly, when projected chip removals are increased from 350 to 600 thousand tons for the Scott City area, the residual net annual growth suitable for chips declines from 25 thousand to a negative 225 thousand tons. That is, for the Scott City area, such a change in demand would lead to an overall excess of removals over growth under this set of assumptions. The implications of this set of scenarios is that if wood demand for chips increases significantly, *and* if all the wood for chips is taken from the growing stock, then the residual annual net growth -- i.e., that remaining after all removals, including for chips, have been accounted for -- will decline, and more rapidly so with greater volumes of removals for chips. Since there is less timber volume to begin with surrounding the Scott City mill, along with higher chip removals (350 thousand tons per year), total chip harvest



Note: Standing growing stock is 3 billion cu. ft.
Nongrowing stock volume (cull) is 1 billion cu. ft. or 31 million tons.
Numerical data may be found in Appendix Tables A1-A4.



Note: Standing growing stock is 2.4 billion cu. ft.
Nongrowing stock volume (cull) is 0.5 billion cu. ft. or 16 million tons.
Numerical data may be found in Appendix Tables A5-A8.

Figure 2. Growth and removals with different levels of chip harvest from growing stock in source areas for Mill Spring and Scott City under alternative assumptions regarding private land availability and the presence of buffers on all roads and bodies of water (Source : Shifley 2000)

will exceed annual net growth at lower harvest levels in the Scott City area than for Mill Spring as the wood demanded by the mills increases.

From an alternative perspective, if the chip mills demands were met exclusively through non-growing stock or cull material (i.e., non-growing as opposed to growing stock), and the same increases in annual removals for chips occurred (i.e., from 200 thousand to 600 thousand tons for Mill Spring and from 350 thousand to 600 thousand tons for Scott City), the supply of cull material to meet the Mill Spring demand would decrease from 69 to 23 years, and to meet the Scott City demand, from 22 to 13 years (Table A-3).

A second set of four scenarios is identical to the above, but adds an additional constraint that reduces land available for timber harvest and thus wood supply to meet total demand (i.e., for chips and other wood products). In these scenarios, it is assumed that, for whatever reasons, private landowners are more reluctant to sell their timber than assumed above and, as a result, the land base (and associated wood volume) available for timber harvest is reduced by 20%. In addition, a further reduction in lands available for harvest was incorporated to account for buffers on all roads and streams, not all of which had been subject to the buffer restriction in the baseline analysis. With the same increases in levels of chip demands as considered above, and with only 80% of the land base available, it is not surprising that the above trends are accelerated. Figures 2b. and 2d. depict these scenarios where all removals are taken from growing stock. Appendix Tables A-5 through A-8 contain the numbers from which these figures are derived, along with projections depicting the situation where all chips are obtained from harvesting of cull material, as opposed to growing stock, in the source areas for the mills.

It is important to note that the likelihood of the assumptions regarding increases in wood demand (and associated chip removals) and the decrease in private land availability actually happening is an entirely different question from the information provided by these scenarios. The latter are intended to provide a picture of how, if any of these harvest levels *did* occur, the results would be translated into changes in two critical variables -- the 'residual' annual net growth for growing stock in the source areas when the demands from chip mills are fully accommodated (i.e., in Figure 2, the differences between 'excess growth suitable for chips' and 'assumed chip harvest levels'); and the supply of chips from cull material available to the mills if these demands were accommodated exclusively through the use of cull materials in the source areas (i.e., in Appendix A tables, the "equivalent supply for chip harvests). With the above kinds of information available, attention may focus more directly on the reasonableness of the assumptions.

Alternative Scenarios Based on Wood Products Data. In the past five decades, a number of timber products output (TPO) surveys have been conducted in Missouri (1946, 1958, 1969, 1980, 1987, 1991, 1994, and 1997). These surveys compiled information from primary processing plants (e.g., sawmills, etc.) to estimate the volume of wood products produced in the state and estimate associated harvest levels.. Over time the detail of these reports has been enhanced; and beginning in 1980, some statistics became available for individual inventory units in the state. However, unlike the statewide forest inventory, which is based on permanent plots on which trees may or may not be

harvested, the TPO reports have been based on where trees are processed into products. The source areas for individual mills are identified by county. Thus with respect to the specific forest locations in which harvests occur, the TPO data is linked to county, while the statewide forest inventory data is linked to permanent plots. With respect to the actual time of harvest, however, timber products data has the advantage of being traceable to the year in which the wood is processed (which in turn is presumably linked more closely to the time of harvest); and this is monitored on a much more frequent basis for TPO data in comparison with the frequency with which FIA permanent plots are re-surveyed. In short, permanent plot and TPO use two different methodologies to arrive at estimates of timber removals. In so doing, permanent plots accumulate information about forest growth but say nothing about products, while the reverse is true for TPO information.

The long-term trends in timber product outputs indicate the general rate at which wood utilization is increasing or decreasing over time. This information on the rate of change in timber product outputs can be used to project proportional changes in future removals. Likewise, past rates of forest growth derived from forest inventory data can be used to project future rates of forest growth. However, all such projections must be viewed with a full understanding of the associated assumptions. The longer the projection period, the less likely the projected outcomes will be correct. Much like forecasts of the weather or the economy, this is true of any model used to forecast the future.

Figure 3 presents trajectories for industrial roundwood production in Missouri from 1946 through

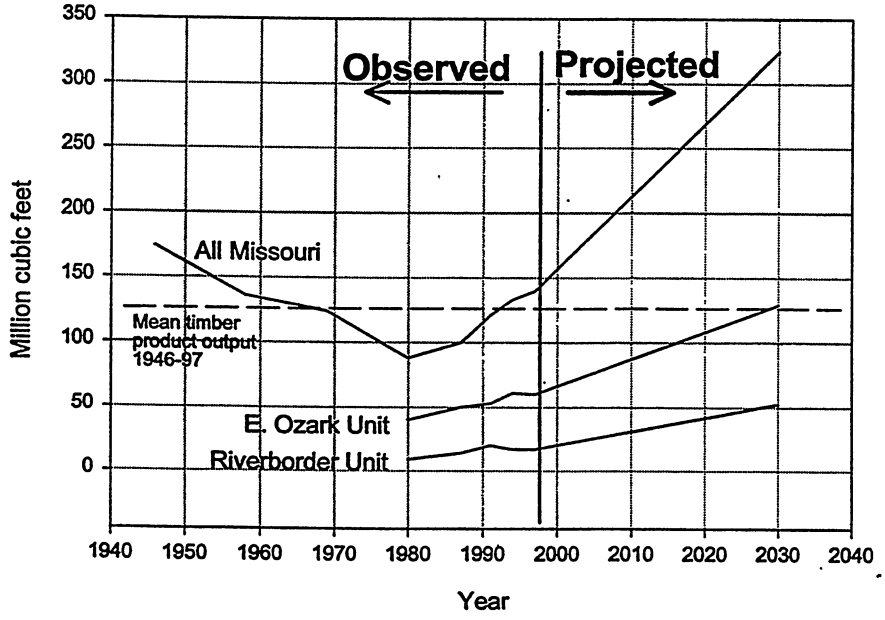


Figure 3. Industrial roundwood production in Missouri (1946-1997) and projections through 2030 based on the historical trend from 1980-1997, prior to the establishment of chip mills in Missouri.
(Source : Piva et al. 2000)
(Note: Actual timber product outputs over the next 30 years are likely to fluctuate rather than increase linearly.)

2030. It is first evident that if the statewide average trend beginning in 1980 were to continue, the projected timber products output level would increase substantially. Similarly, if mean timber output from 1946 through 1997 were to continue, a much lower trajectory would occur. Neither of these trajectories is certain. On the one hand, timber outputs rarely if ever increase (or decrease) in a linear fashion over an extended period, but fluctuate up and down due to market price and other demand-related factors. This statewide picture, therefore, presents two sideboards reflecting the usual starting point for any projection efforts -- i.e., a linear extrapolation of historical trends. Moreover, it is clear that the extent of time encompassed by such trends will likely have a significant effect on the resultant projections. It is likely that the more recent trends are closer to present-day reality than those stretching into the far distant past. In any case, both these trends (i.e., 1980-1997 and 1946-1997) may be viewed as 'sideboards' within which the actual level of timber products output will likely fall over the next 30 years. The scenarios which follow are based on the 1980-1997 trend for the Eastern Ozark and Riverborder units as shown in Figure 3. In this light, they are inherently conservative in nature -- i.e., timber production may not increase at this same rate for the next 30 years. and more wood may be available for harvest than the scenarios will suggest.

For the Eastern Ozarks, it is clear that an upward trend in timber products output, not as steep as the aggregate statewide pattern, commenced in 1980; it did, however, level off in the mid-1990's, and it is unclear exactly which trend will emerge over the next several decades. It should be noted, however, that the timber products output generated by the two chip mills since their arrival in southeast Missouri in the latter 1990's has not as yet entered into the TPO figures, and this could, of course, affect the future trajectory of product output in the Eastern Ozarks. Wood products output for the chip mills will be accounted for in the next TPO survey.

Based on the wood products data described above, a set of 14 additional scenarios was constructed depicting possible long-term trends in timber resource availability over the period from 1989 to 2030 (Shifley 1999b; 2000). From this perspective, two key questions include: Can Missouri forests meet the requirements for chip supply? Can Missouri forests do so while meeting the assumed increase in overall (non-chip) wood demand in the future? These are not the *only* important questions in the 'chip mill issue;' they are, however, the ones that these projections are designed to address.

The scenarios based on wood products data incorporated combinations of the assumptions used in the previous inventory-based analysis. For all scenarios, the supply of wood potentially available for chip was first reduced by 29% for road and stream buffers, steep slopes, and unusable species; this result was then further reduced by 27% (Mill Spring) and 19% (Scott City) for assumed unavailability of public lands as a timber source; and these combined reductions to the available wood supply were then reduced by 16% to account for source area overlap. For each source area, several of the scenarios also included an additional 20% reduction of the available land base (and associated available wood supply) to reflect private landowners who might not want to sell timber. Finally, the scenarios include increasing levels of demand for chips by the two mills, ranging from 200 thousand to 1 million tons per year for the Mill Spring facility, and from 350 thousand to 1 million tons per year for the Scott City mill. The scenarios are depicted in Figures 4 through 6, and individual scenarios are identified in Table 5.

Table 5. Scenarios for chip mill demands under two levels of private land availability

Chip mill demands (thousand tons)	*Mill Spring* Private lands available 100%	*Mill Spring* Private lands available 80%	*Scott City* Private lands available 100%	*Scott City* Private lands available 80%
	Figures			
200 (Baseline: MS)	4a	4b	Figures	
300	5a	5d		
350 (Baseline : SC)			4c	4d
600	5b	5e	6a	6b
1,000	5c	5f	6c	6d

Underlying Assumptions : All Scenarios

A. Available wood supply reduced by: 29% –> For buffers, slopes, and unusable species
B. *A* is further reduced by : 27% (Mill Spring) and 19% (Scott City) –> For unavailability of public lands
C. (A + B) is further reduced by : 16% for source area overlap

In examining the scenarios, it is first worthwhile to consider what may happen if the current anticipated wood utilization patterns by the two chip mills were to continue (i.e., 200 thousand and 350 thousand tons of chips per year by the Mill Spring and Scott City facilities, respectively), and 100% of private lands in the mill sourcing areas were available for harvest (Figures 4a and 4c). The other assumptions involving reductions in available wood supply for chipping as described above are assumed to be in place.

For the Mill Spring facility, over the next 30 years (2000-2030), standing growing stock increases from 3.6 billion cubic feet and begins to level off at about 4.6 billion cubic feet; while standing non-growing stock (cull) rises at a slightly decreasing rate from just over one billion to slightly under 1.5 billion cubic feet. Over this period, annual growth of growing stock increases at a decreasing rate from about 116 million cubic feet to about 150 million cubic feet; while annual harvest for growing stock products other than chips rises at an increasing rate from 64 to 133 million cubic feet by 2030. Volume available for chips -- i.e., net annual growth adjusted for the various assumptions described above -- initially exceeds the 200 thousand tons (7 million cubic feet) chip harvest level and gradually declines over the 30-year period from 23 to 7 million cubic feet, thus equaling removals for chips.

From the above we may conclude that, given the assumptions underlying all scenarios, and with a continuation of anticipated present volume of chip utilization by the Mill Spring facility, if the entire chip harvest were taken from the growing stock, harvest from growing stock in the sourcing area would eventually equal annual growth in about three and one-half decades (2000-2035). By that time, total standing growing stock would be leveling off at around 4.5 billion cubic feet.

In the more restricted scenario in which only 80% of private lands are assumed to be available for chip harvest and buffers are assumed to be left on all roads and water bodies in the sourcing area

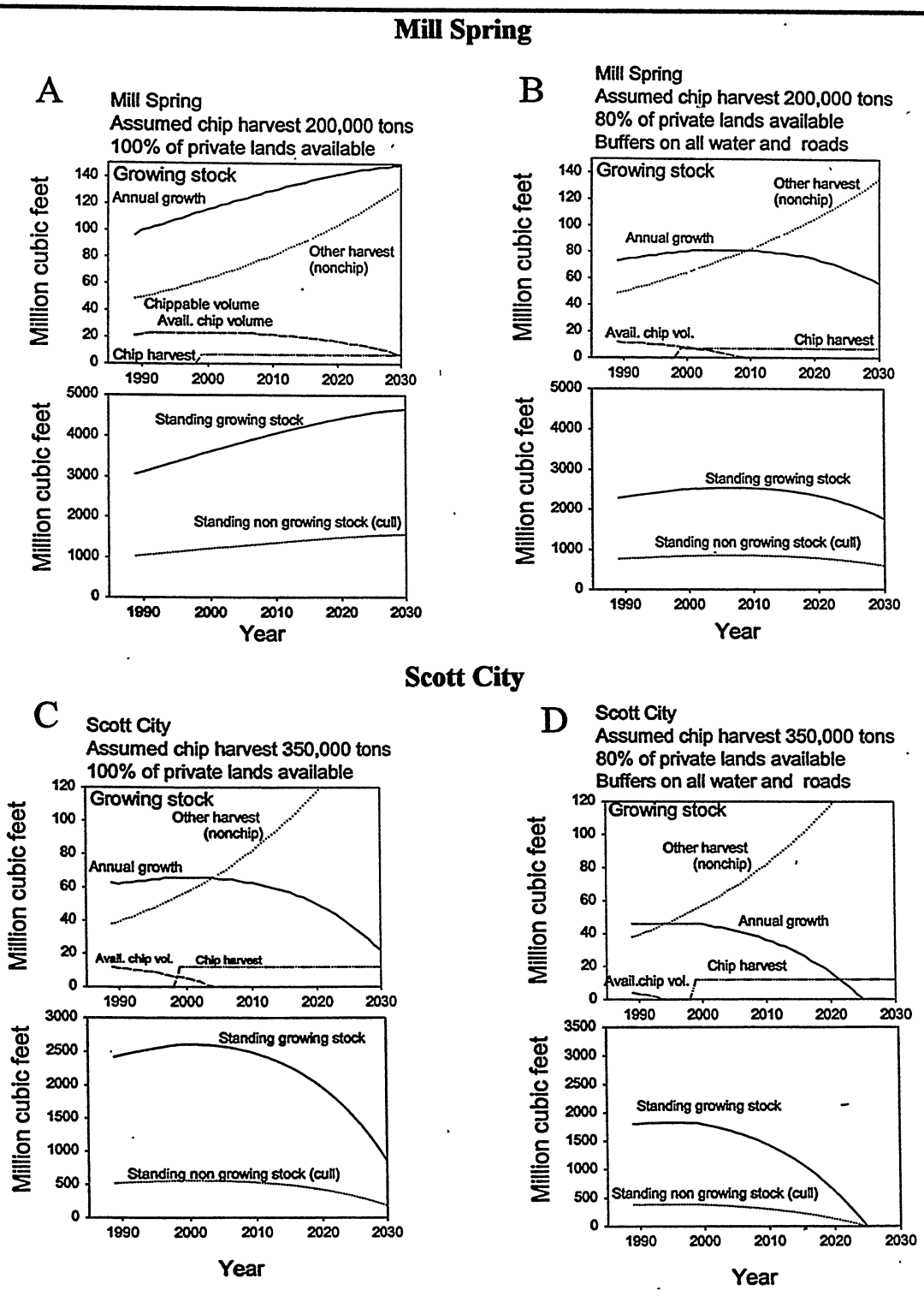


Figure 4. Annual growth and removals, and excess growth suitable for chips, within a 60-mile radius of the Mill Spring and Scott City mills, under current anticipated volumes of chip utilization at two levels of wood availability from private lands (1990-2030) (Source: Shifley 1999b; 2000)

(Figure 4b),[10] it is evident that annual growth of growing stock in the sourcing area begins to decline from a peak of about 81 million cubic feet in 2010, at which time harvest of growing stock for other than chips passes (i.e., begins to exceed) annual growth and continues to increase at an increasing rate. By 2030, annual growth is 56 million cubic feet and nonchip harvest is 135 million cubic feet. In this scenario, chip harvest is already equal to available volume for chips in the year 2000, and the difference becomes negative thereafter. Also, standing growing stock remains far less than the case where all private lands are assumed to be available for chip harvest and the assumption of buffers on all water and roads is removed (i.e., Figure 4a). Moreover, this lower level of standing growing stock itself reaches a peak of 2.5 billion until about 2005 and then gradually declines. In both of the above scenarios (Figures 4a and 4b), volume of non-growing stock (cull) is sufficient to meet the anticipated demand for chips.

When attention turns to a continuation of the anticipated level for annual chip harvest from the sourcing area for the mill at Scott City (i.e., 350 thousand tons or 12 million cubic feet), the following scenarios emerge (Figures 4c and 4d). Given the lower total growing stock in the source area and the higher level of annual harvest for chips required by the Scott City facility in contrast to that of Mill Spring, it is not surprising that projected annual growth of growing stock in the sourcing area under this scenario has already leveled off at 63 million cubic feet in the year 2000 and begins to drop within five years thereafter, ultimately declining by two-thirds to 20 million cubic feet by 2030. By the year 2005, harvest of growing stock other than chips passes (i.e., begins to exceed) annual growth and continues to increase at an increasing rate. Moreover, growing stock volume available for chips had already begun to decline by 1990 and annual chip harvest exceeded this volume when the Scott City mill began operating. Under this scenario, standing growing stock in the source area is projected to have already peaked at 2.6 billion cubic feet in the year 2000 and to decline to 800 million cubic feet by 2030. Standing non-growing stock (i.e., cull) remains steady at about 500 million cubic feet through 2005 and then gradually declines. Volume of non-growing stock trees is sufficient to meet the demand for chips under this scenario.

When the more restrictive assumptions regarding private land availability and buffer areas are incorporated into the above scenario (Figure 4d), the above pattern is substantially accelerated. Annual growth of growing stock has already dropped below the non-chip harvest level by 1994 and continues to decline at an increasing rate, reaching zero in about 2025. By the time the mill begins operating in 1997, any excess growing stock volume potentially available for chips has disappeared. Under this scenario, standing growing stock in the Scott City source area begins to decline from a peak of about 1.8 billion cubic feet in the year 2000 to zero by 2025. Volume of non-growing stock (cull) is sufficient to meet the demand for chips throughout most of this projection period, although it too approaches zero by the year 2025.

Given the inherent uncertainty in long-range projections, as well as the restrictive assumptions that ensure a conservative projection of future wood supply, the long-term implications of this analysis

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[10] These are in addition to the common set of assumptions described earlier which apply to all scenarios and serve to reduce the land available for chip harvest.

are tentative at best. However, they do reflect an educated estimate, using the best resource data available, regarding possible answers to the two key questions posed above. When focusing on *growing stock* (as opposed to cull material) as a potential source of chips, and with 100% availability of private lands for wood products, there is probably enough wood as growing stock to meet the 200 thousand ton annual demand for chips by the Mill Spring facility for at least the next three decades before volume available for chips declines to the level of chip harvests. For the Scott City facility, whose source area is only 31% timberland (as opposed to 58% for the Mill Spring source area), under these scenarios the growing stock volume available for chips has already dropped below the 1997 anticipated utilization level of 350,000 tons for the mill when it began operations. This in part reflects the fact that for the Scott City source area from 1992-1997, timber harvest was already increasing more rapidly on a percentage basis than was annual growth. During that time growth increased by 2.3% per year, while harvest increased by 3.7% annually. Thus even with no chip mill, potential wood supply from growing stock was declining in this area. If all of the Scott City facility's annual demand for chips (350 thousand tons) were to be supplied from growing stock in its source area, the volume of wood harvested for chips in the area would already exceed the growing stock volume available for chips as soon as the mill began operating.

Finally, when we impose the more restrictive assumption that only 80% of private lands in the source areas are available for timber harvesting, nonchip harvest exceeds annual growth much sooner (by 2010) in the Mill Spring area and chip harvest exceeds available chip volume shortly after the year 2000; while for the Scott City area, nonchip harvest had already exceeded annual growth in the early 1990', and the latter, along with standing growing stock, drop to zero by 2025. In both cases, but especially that of the Scott City mill, the sustainability of the forest resource in the source areas would obviously be greatly enhanced via the mills' utilization of the substantial volumes of cull materials within the forestlands surrounding the mills, in contrast to relying exclusively on growing stock in harvesting for chips.

Figures 5 and 6 present scenarios for Mill Springs and Scott City in which levels of chip harvest are assumed to increased above the baseline current anticipated levels of 200,000 and 350,000 cubic feet, respectively. In the top row of each figure, it is assumed that 100% of private lands will be available for timber harvesting in the source areas at each level of chip utilization; while the bottom rows incorporate an assumed 20% reduction in the availability of these lands. The assumptions restricting land (and wood available for chipping) common to all scenarios (Table 5) are also in place in these projections.

For the Mill Spring facility, with all private lands assumed to be available for timber harvest (Figures 5a-5c), an increase in chip utilization to 300 thousand, 600 thousand, and one million tons annually is reflected in the lower trajectories for standing growing stock, along with earlier peaks and subsequent declines. This is mirrored in similar trajectories and peaks for annual growth, as well as earlier points in time when nonchip harvests meet and exceed annual growth. Finally, as would be expected with increasing levels of chip harvest, the latter exceed growing stock volume available for chips at increasingly earlier points in time as levels of chip utilization increase, from about 2027 in the 300 thousand ton scenario to the mill start-up time in 1997 for the one million ton scenario. When

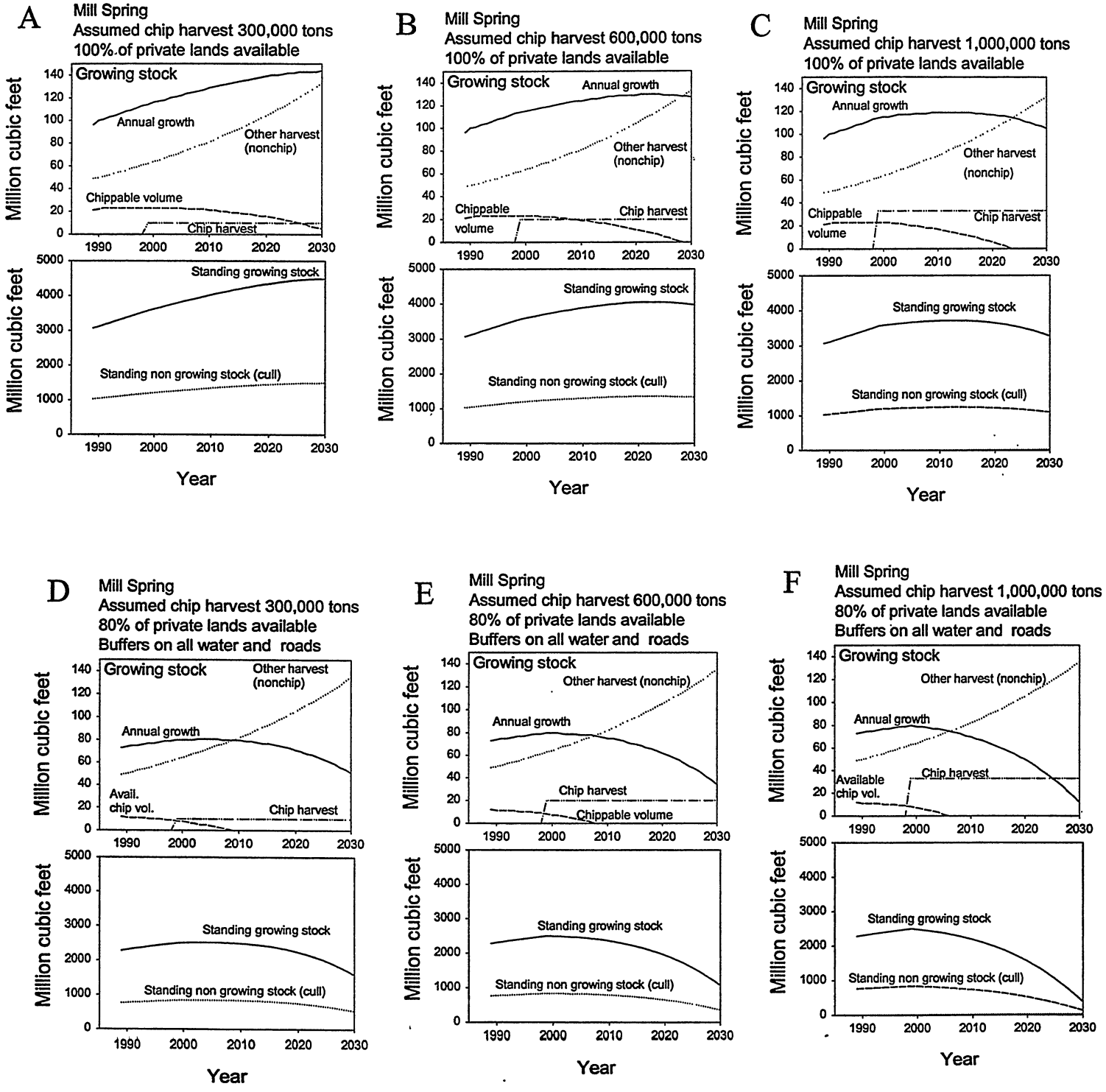

Figure 5. Projected growth and harvest levels from growing stock within a 60-mile radius of Mill Spring facility under increasing volumes of chip utilization at two levels of wood availability from private lands (1990-2030). (Source: Shifley 1999b; 2000).

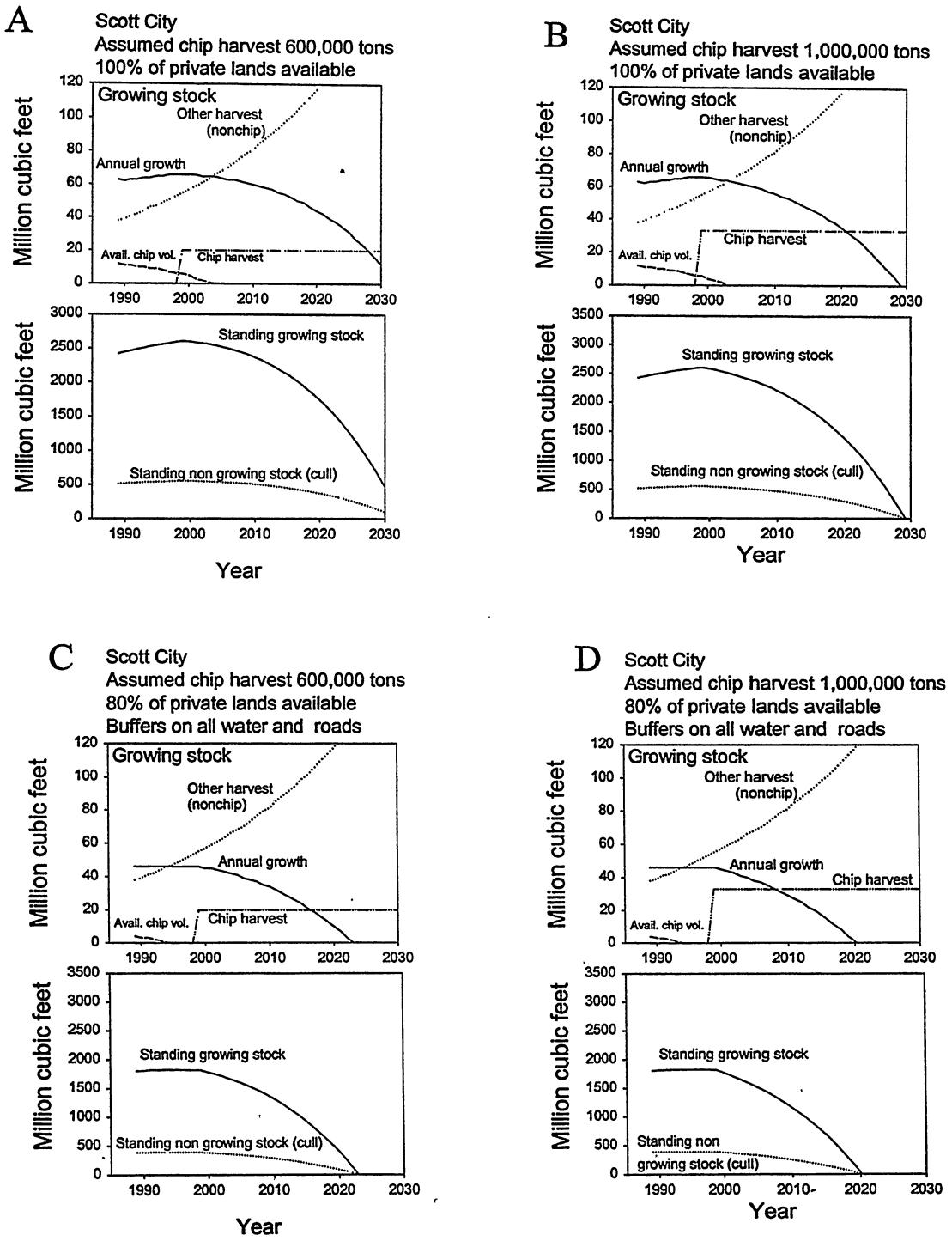

Figure 6. Projected growth and harvest levels from growing stock within a 60-mile radius of Scott City mill under increasing volumes of chip utilization at two levels of wood availability from private lands (1990-2030). (Source: Shifley 1999b; 2000).

only 80% of private lands are assumed to be available for timber harvest (Figures 5d-5f), in addition to lower overall levels and more rapid declines in standing growing stock and annual growth, growing stock volume available for chips disappears more rapidly as the gap between available volume and chip harvest levels widens.

With respect the mill at Scott City, projections derived from assumed increases in annual chip utilization to 600 thousand and one million tons are depicted in Figure 6. Given the lower volume of timber resource in the source area relative to that of Mill Spring, the impacts of increased chip utilization on standing growing stock and annual growth are both more immediate and dramatic. When 100% of private lands are assumed to be available for timber harvest (Figures 6a and 6b), standing growing stock declines from the point in time in which the mill begins operating (1998) and would actually be exhausted by 2030 in the one million ton chip utilization scenario. Annual growth also rapidly declines from the time the mill begins operating. Since chip harvest is well above the growing stock volume available for chips when the mill begins operating, the latter rapidly disappears in a few years. When only 80% of private lands are assumed to be available for timber production (Figures 6c and 6d), the above pattern is accelerated. This yields a situation in which standing growing stock (and annual growth) are exhausted by the year 2022, and growing stock available for chips had disappeared several years before the mill began operations.

The analysis of scenarios can also shed some light on, while not answering completely, the question of additional chip mills locating in the state relative to potential wood availability. Thus, for example, the increasing levels of demand for chips in the source areas could be interpreted not simply as arising from one mill, but from additional mills locating in the state. Effects of new mills on timber growth and removals in the source areas would obviously not likely emerge from a new mill locating immediately adjacent to an existing one, but would more likely be manifest in the overlapping of certain portions of different source areas. It is almost a truism, however, that in terms of wood supply, the location of any additional mills will be a vital consideration in terms of their possible effects on the forest resource. It is clear from this analysis, for example, that -- in terms of growing stock -- locating another mill in the overlapping source areas of the two existing mills would not bode well in terms of sustainability of growing stock from a net annual growth perspective, unless nongrowing stock (cull) were used to supply the raw material. Potential impacts become harder to assess as we move away from the source areas. On an overall basis, many of these questions regarding viable source areas, economic feasibility, environmental soundness, and so on, could be -- and are, in some states -- addressed in the permitting process when mills first apply for clearance to locate in a state. Finally, the above discussion has pertained primarily to growing stock volumes as a potential source of chips. Availability and likely utilization of cull material for chips are also critical aspects to be considered. Regarding the former, Missouri clearly has an ample supply; so attention turns to the question of how much of this material is likely to be utilized.

It has been emphasized that the assumptions common to *all* the scenarios described earlier lead to inherently conservative estimates of potential wood availability for harvest in the chip mill source areas. In the case of the Mill Spring area, for example, Table 4 indicates that the difference between annual growth and annual removals results in 48 million cubic feet of net annual growth. When the

combined effects of the adjustments (i.e., reductions) to net annual growth arising from the assumptions listed at the bottom of the table are applied to the above figure, the net annual growth is reduced by 54% to 22 million cubic feet. This figure represents the adjusted excess growth (i.e., growth - removals) in the Mill Spring source area that is potentially available for chips (and, of course, other wood products as well). These same assumptions contributing to adjusted net growth underlie the scenarios listed in Table 5. The figures and graphics depicting the scenarios are direct results of projections made with these assumptions in place.

Several points merit emphasis with respect to the above. First, different groups with different visions for the management of Missouri forests may be more or less comfortable with different sets of assumptions. Secondly, it is possible to prepare any number of scenarios for growth, removals, chip harvest levels, and so on, in the mill source areas and elsewhere. Thus, for example, a 'liberal' scenario relative to wood availability could be constructed just as readily as the more conservative approach used in this analysis. Estimates of growth increases through better management could also be incorporated. Thirdly, efforts to ensure the sustainability of Missouri forests also depend on other kinds of assumptions and resultant scenarios in addition to those directly related to timber growth and yield. Many such assumptions or expectations focus on social actions that may have repercussions for Missouri forests, and their scope may extend well beyond the boundaries of the state. Thus, for example, based on estimates by the mills themselves, the baseline demand (expected utilization) levels for chips utilized in the preceding analysis have been 200,000 tons (7 million cubic feet) and 350,000 tons (12 million cubic feet) for the Mill Spring and Scott City mills, respectively. This reflects the assumption that the above figures all represent demand levels for these mills operating at average capacity (e.g., one shift). However, it is not inconceivable that demand for chips stimulated by, for example, a recovering and/or expanding economy in the Pacific rim could encourage mills to expand beyond average capacity to a greater or lesser degree. Such a 'social scenario' could be translated into projected demand levels for chips, incorporated into the above kinds of projections, and interpreted in terms of potential impacts on the sustainability of Missouri forests.

The key point of all of the above is that it is the *assumptions* underlying the scenarios that will shape the results that are interpreted by those with differing perspectives on the long term viability of the state's forests. For some, the assumptions employed in this report may reflect a cautious yet reasonable approach toward sustaining the state's forestlands; for others they may seem too cautious and, therefore, unrealistic. Given the substantial degree of uncertainty inherent in any such effort, such differing perspectives are virtually inevitable. Like any aspect of public policy, the most fruitful pathway to reconciling these differences is to be found through open discussion of the logic, reasonableness, and desirability of the assumptions underlying our efforts to predict the vital factors that will ultimately determine the sustainability of Missouri forests.

In summary, understanding the relationships among availability of standing volume and annual growth -- both growing stock and cull material -- and removals for sawtimber, chips, and other wood products is one key ingredient for arriving at viable policy alternatives that encourage sound utilization of Missouri's forest resources in a sustainable manner. At the same time, all that is standing is not necessarily economically available (even after reductions for the assumptions used

above); and what is available will not necessarily be utilized. Factors affecting these other aspects of the 'chip mill issue' are the focus of the following pages.

Forest Land Change Detection

Changes in the composition and structure of Missouri forestlands are at the heart of the question of the ecological and economic sustainability of the state's forest resource base. The USFS forest inventory and analysis data (FIA) provides important information in this regard -- collected from about 5600 points in forested landscapes in Missouri. But due to the density of the sampling, it is difficult to make inferences from this data for areas smaller than the county level. However, another technique for assessing changes in Missouri's forest land base is available that may complement the statewide forest inventory.

Satellite remote sensing (RS) is a methodology which can be used to classify areas on the basis of amount of *biomass.*[11] Satellite RS systems record electromagnetic radiation (EMR) from target objects. The data produced is multi-spectral; sensors on the satellite collect information in six bands including, but extending beyond, the range of the human eye. The thematic sensor can 'see' well enough to detect changes in forest cover with a high degree of accuracy. RS data for monitoring forest cover has a spatial resolution (i.e., grain or pixel size) of 30 meters. With this it is possible to produce scenes that measure about 185 kilometers on a side.

In this way, data or images can be used to establish a baseline for monitoring the area and location of change in the Missouri Ozarks. Remotely-sensed data yields a snapshot in time, which cannot be accomplished on the ground; it is not possible to sample large forest areas and provide an instant picture of the results. Using remotely sensed data, different kinds and intensities of harvests would appear differently in terms of colors of images. It can reveal that *x* acres of forest land *is no longer* forest land the next year, and it can pinpoint the location of those acres. However, such data may not be able to answer the question as to whether the land was harvested or bulldozed . What it does provide is location-specific information that the land *was* forested and now is not, based on the amount of biomass present.

Remotely sensed data also cannot directly reveal whether any growth has occurred on the site (e.g., via replanting or otherwise) until such growth reaches a certain size. Thus, for example, using satellite imagery alone, it would likely take three to five years to determine that after an area is cleared it is being allowed to grow back as forest land. When seedlings are just emerging and immediately after, their color & transparency are similar to that of grass. But after growing dense and tall enough, they exert a cooling effect on the micro-areas immediately around them; and this is perceived by the satellite sensors and expressed in different colored images

When used as a tool to understand the pattern and extent of timber harvesting across the landscape,

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[11] The principal source of information for this discussion of satellite remote sensing is Diamond (1999).

the following picture of what RS data can do emerges. Consider, for example, the case where two scenes of same area are produced -- one from 1986 and one from 1992 Also assume there is 50,000 acres less forest in 1992. How would one determine how much of that 50,000 acres is pasture and how much of that land has been recently harvested and is in the process of re-growing a forest? It would not be possible to ascertain this directly from the 1992 scene. However, there are ways this data can be incorporated into such efforts to detect forest land change. On the one hand, with a continuing series of updated images, this could be monitored more closely. Another approach would be to select a random sample of those cleared areas (in the 1992 scene) and obtain a statistical measure of what percentage of them are pasture, regenerating forestlands, and so on.

This kind of data and information can also indirectly have a positive impact on how privately-owned forestland is managed. It can be very useful for public agencies in developing programs for private forestry that provide incentives for landowners to manage in ways that are both ecologically sound and financially beneficial. It allows agencies to have a better landscape picture, so that in identifying areas at risk (e.g., bottomland hardwood forests) they can better tailor programs in ways that would be appealing to those landowners. Other advantages of RS data are related directly to its value in conducting ecological assessments. Remotely sensed data can be used to assess key variables essential to understanding large-scale relationships essential to ecosystem health. Thus, for example, it is valuable for forest edge and interior detection that may be critical habitat factors for the viability of certain wildlife species. It is also used for characterizing features of watersheds that capture their role in important hydrological processes.

Remotely sensed data can be archived; it does not have to be analyzed immediately. Moreover, a data bank already exists for Missouri from the period when satellite orbits began (1971) through the present. Thus, for example, data for 60-mile radii around Mill Spring and Scott City between 1971 and 1999 may be accessed from the archives. Of course, satellite images must be purchased from the agency or organization controlling the satellite's operation. A new satellite has recently gone up, and the U.S. Geological Survey is controlling the policy for the data distribution from that satellite. While the revised cost structure is yet to be finalized, the current cost of RS imagery (i.e.,for a 185 km^2 image for before any work is done with it) could range from $900 per image at a minimum (probably more) to $2500 at a maximum (likely not that high). Nonetheless, it can be obtained quickly and relatively cheaply versus any other technique for large areas. Moreover, results can be combined with other spatial data layers in a geographic information system (GIS) for analysis. Finally, data depicting forest cover and other land characteristics can be updated relatively quickly, given that the satellite passes over every sixteen days. In Missouri, the organization most closely involved with use of satellite imagery in the field of natural resources is the Missouri Resource Assessment Partnership (MORAP), which is based at the University of Missouri-Columbia. The organization is funded entirely through partnerships with state and federal natural resource agencies. MORAP data is stored on a USGS server at the Columbia Environmental Research Center.

Both the statewide forest inventory (FIA) and the remote sensing capabilities of MORAP provide important tools for enhancing the sustainability of Missouri forests. Their most effective use will, however, come not separately but as part of an integrated resource assessment package for

monitoring the status of and patterns of change in the state's forestlands. With the improvements in FIA methodology, it will now be possible to inventory (via sample plots) one-fifth of the state's forest lands each year, thus reducing the overall inventory cycle to five years. Remotely sensed snapshots of large contiguous forestland areas provides and added dimension to the FIA data derived from sample plots, allowing for the monitoring of many important landscape-level ecological variables. Moreover, such images of areas within, for example, an individual county provide a valuable source of information on characteristics of smaller areas of forestlands, compensating to some degree for the rather limited ability to make inferences from FIA data to sub-county areas. In summary, some powerful tools are available for understanding and assessing the diverse forestlands of Missouri; the challenge remains that of combining their distinctive capabilities in the most effective way to ensure a sustainable forest resource base.

B. SUSTAINABLY MANAGED FORESTS

The impact of the chip mills on Missouri forestlands will be played out in the kinds of forest practices -- whether or not they qualify under the heading of 'management' -- that are undertaken by the state's nonindustrial private forestland owners who will furnish the bulk of the wood supply to the mills. In effect, the 'chip mill issue' is bigger than the chip mills *per se*. From a timber perspective, it extends across a continuum of wood flows from privately owned land, through the loggers, and to the mills. While the mills can certainly influence this process -- and if and how they do so is an important concern -- they do not control it entirely. For example, based on the previous discussion, it can be said that if sustainable forest management is practiced by Missouri landowners that there will likely be enough standing timber to supply the existing mills for some time, possibly even with *some* increases in demand.

It is also widely recognized that Missouri's private forests have been, for the most part, managed poorly and without professional guidance for some time. Thus the 'problem' of sustainable forest management in Missouri precedes the chip mills, although the latter may certainly influence it. In addition to a sustainable forest resource base, another central outcome envisioned by the members of the Governor's Advisory Committee is a situation of *sustainably managed forests* in the state. In considering this thematic area, a first concern centers around what it is that this kind of management would involve on the part of, in particular, Missouri's nonindustrial private forestland owners. Attention then turns to more practical aspects of how this might be achieved through forest management; the potential that such management could be conducted in a way that is profitable to Missouri landowners; and some possible impacts of the chip mills on such a process.

What is Sustainable Forest Management?

In recent years, the notion of sustainability with respect to forests and natural resources has become a catch phrase to signify a more enlightened approach to understanding and managing forests and other natural resources. Actually, however, the concept has been around for a long time, and its roots may be traced to the profession of forestry. In the 1880's, when resource management in earnest was just getting started in the United States, it was strongly influenced by many European foresters -- especially Germans -- who in coming to this country brought with them well-formed ideas about forestry anchored in the concept of *sustained yield* and managing forests over the long-term and maintaining productivity. In 1905, Secretary of Agriculture James Wilson declared that the country's National Forests were to be managed for the development and administration of their renewable surface resources for the multiple use and sustainable yield of their various products and services.

In the early days of forestry in this country, the emphasis had focused primarily on sustained productivity of forests for timber. But it was also recognized that sustained timber production was dependent upon, in particular, sustaining the viability of soils and watersheds. Today people are still

concerned about these areas, but society's values have expanded to give increased emphasis to sustaining other forest resources as well, including wildlife and plant species, as well as a range of environmental factors. At the national level, the Multiple Use Sustained Yield Act of 1960 established this resource management philosophy as Congressional direction for the National Forests, and that in turn encouraged adoption of that perspective by other federal and state agencies -- including the Missouri Department of Conservation -- and many private forestland owners (Law 1992).

Nevertheless, although it is a socially and politically potent concept, sustainability is frequently not well defined. For much of the past century, forests have been viewed as sustainable if the periodic growth of commercially useable timber was at least equal to timber removals. Over the past several decades, this idea has been expanded to include other uses of the forest such as recreation or other services without a significant decline in either quantity or quality. In the 1990's, moreover, sustainability has come to include the maintenance of well-functioning ecological processes, which in turn are seen as the basis for a variety of ecosystem services important to humans. The ecological perspective has also fostered a vision of humans as not situated above and beyond the ecosystem, but within it. Thus the focus of sustainable ecosystems has come to include not only the traditional biological processes characteristic of forests and other natural systems, but also humans as members of ecological communities (Leopold 1987 [1949]).

In this light, it is first worthwhile to briefly recognize two contemporary perspectives or visions of the kinds of considerations that are involved in sustainable forest management in Missouri. A first vision of *sustainably managed forests* has been endorsed by the American Forest and Paper Association through their Sustainable Forestry Initiative (SFI) program. The association has produced a set of guidelines outlining what it considers to be important elements of sustainably managed forests to which their member firms are expected to conform (Table 6a). This reveals how forest industry translates the idea of forest sustainability into a number of concrete on-the-ground management activities. While the monitoring of the SFI Initiative is at this point based on a system of self-reporting by member companies, third-party verification remains a topic of discussion and some firms have adopted it voluntarily.

Another contemporary perspective of sustainably managed forests reflects the principles expressed by the Forest Stewardship Council [FSC] (Table 6b). The principles imply that the idea of sustainable forests and their management encompasses a variety of important goals including an economy that affords opportunities for a meaningful quality of life, equity of opportunity for achieving well-being, and environmentally sustained and protected natural resources for future generations. While the FSC's perspective focuses less directly on the specific kinds of forest practices that together may contribute to sustainability, it highlights many of the broader social and economic concerns that are also vital considerations if sustainably managed forests are to become a reality. It also adds an international flavor to the concept, reminding us that these concerns are not those of Missourians alone, but are shared by peoples around the world as part of a truly global economic, social, and ecological system.

These two perspectives complement one another in defining a framework for sustainable forest

Table 6a. Sustainable forest management as reflected in *Sustainable Forestry Initiative* guidelines for member companies of the American Forest & Paper Association (AF&PA). (Source : AF&PA 1998)

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1) *Broadening the practice of sustainable forestry* : Require members to develop specific programs, plans, and policies to achieve sustainability. Support research.

2) *Cooperating with private landowners and loggers* : AF&PA members will work with the forestry community in each state to inform other woodland owners about the benefits of reforestation; promote the establishment of training programs for loggers; and support & promote other landowner education efforts.

3) *Protecting water quality* : Implementation of best management practices (BMP's) is key to protecting water quality in streams and lakes -- BMP use required for SFI participants. This may include implementing erosion control measures on roads & skid trails & leaving vegetated buffer strips along streams

4) *Minimizing the visual impacts of harvesting* : Management of clearcut size : On member company lands the average clearcut size is required to be less than 120 acres. Adjacency requirement : For adjacent stands that will be harvested, original clearcut site must have trees that are at least 3 years old or 5 feet tall

5) *Promptly reforesting harvested areas* : Replanting is required within two years of harvest . For natural regeneration, stands must be established within five years

6) *Contributing to biodiversity* : Use adaptive management (logic of scientific experimentation) and support research to learn more about how to manage lands for biodiversity and conserve biodiversity

7) *Enhancing wildlife habitat* : Where appropriate, enroll lands and/or streams in wildlife & fisheries agreements with conservation groups and public agencies that specify on-the-ground management practices

8) *Protecting special sites* : Identify and appropriately manage sites which have ecological, historical, or geologic significance

9) *Continuing the prudent use of chemicals prudently* : Prudent use of herbicides and fertilizers to restore health and productivity of lands damaged by insects, disease, or natural disasters; to ensure successful reforestation following harvest; and to improve forest productivity, and enhance wildlife habitat. Meet or exceed all federal, state and local laws & regulations.

10) *Continuing to improve forest utilization* : Employ the appropriate technology, processes and practices to minimize waste and ensure the efficient use of trees harvested.

11) *Providing opportunities for public outreach* : Encourage mechanisms to facilitate interaction with the public, government policy makers, and opinion leaders about program goals.

12) *Publicly reporting progress* : Member companies will report annually on their compliance with guidelines; AF&PA will issue and annual report regarding its memberships' performance; and a panel of independent experts will validate information reported in the annual progress report.

Table 6b. Forest Stewardship Council : Principles of Forest Management (FSC 1994)

1. Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC principles and criteria.

2. Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.

3. The legal and customary rights of indigenous peoples' to own, use and manage their lands, territories, and resources shall be recognized and respected.

4. Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.

5. Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

6. Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and by so doing, maintain the ecological functions and integrity of the forest.

7. A management plan -- appropriate to the scale and intensity of the operations -- shall be written, implemented, and kept up to date. The long term objectives of management, and the means of achieving them, shall be clearly stated.

8. Monitoring shall be conducted -- appropriate to the scale and intensity of management -- to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

9. Primary forests, well developed secondary forests and sites of major environmental, social or cultural significance shall be conserved. Such areas shall not be replaced by tree plantations or other land uses.

10. Plantations should complement natural forests and the surrounding ecosystem, provide community benefits, and contribute to the world's demand for forest products.

management that goes beyond abstract generalities to outline the kinds of attitudes and concrete technical and social processes that will be required if sustainable forest management is to become a reality.

In light of the above, the Governor's Advisory Committee on Chip Mills, when considering its role in contributing to the formulation and management of public policies for enhancing *sustainably managed forests* in Missouri, agrees with the National Research Council (1998) that such programs and policies should :

a) Promote a long-term investment in Missouri's (and the nation's) forestlands;
b) Recognize and respect a mixed public-private system of ownership;
c) Encourage multiple forest uses consistent with the long-term integrity of forest ecosystem functions and processes;
d) Promote citizen participation in determining the care and management of the state's forest resources; and
e) Maintain the productivity of forest ecosystems for a full range of values, functions, and

services.

This will require investments in human and natural capital, biological integrity, financial soundness, and institutional strength. Such investments will also depend on broad-based social and political support, including a willingness to recognize and address fundamental issues affecting the future of our forests and other natural resources.

Levels and Intensity of Forest Management

Stand structure and dynamics. Oak has historically been among the dominant overstory vegetation components in this part of the country, and about three-fourths of Missouri's forests are dominated by oaks (Spencer et al. 1992). The oaks usually persist as the dominant members of stands facilitated by a natural regeneration dynamic that favors accumulation of oak seedlings and seedling sprouts beneath the canopies of mature stands. It is the resultant buildup of this reproduction, which can occur in the absence of fire or disturbances, that distinguishes Missouri's oak forests from similar forests in other ecoregions (Walter and Johnson 1999). Many of the resultant seedling sprouts grow rapidly in height after natural or man-caused disturbances to the forest canopy that increase the sunlight near the forest floor. Such disturbances, combined with the oak's ability to sprout from the bases of cut or fire-killed trees, assures the continued dominance by oaks.

The structure of Missouri forests may be described with the aid of two general terms. Even-aged stands are comprised of trees of a single age class. Uneven-aged stands are made up of at least three age classes of trees closely intermingled in the same area (Smith 1986). An even-aged forest goes through a fairly regular progression of development. From establishing the new reproduction if completely utilized as a site, it moves into a stage of self-thinning in which as the trees grow, they thin out due to competition. As they get larger, other gaps are created in the canopy, allowing reproduction to become established under the canopy. Finally, the stand progresses into an old growth phase. In the development of uneven-aged stands, the same sorts of processes occur, but they do so at a different scale. Individual trees may die or be removed, but basically the same principles are at work -- as stands age over time the volume changes and the characteristics of the forest change.

Increasing volume yield through management. As described earlier, Missouri forests have an abundant amount of cull material mixed in with the growing stock. Based on assumptions used in the analysis of statewide inventory data for 1972 and 1989, estimates of *potential* net annual growth resulting directly from *better forest management* range as high as 650 million cubic feet, although not all of that would be suitable for harvest. 'Better' forest management would involve practices that can increase net growth in Missouri forests, including :

- Replacing cull trees with growing stock
- Timber stand improvement to shift growth to best trees
- Intermediate stand treatments such as thinning where practical

Forest management can increase the total volume yield of a forest stand. This is usually accomplished

by thinning and intermediate harvests. These practices increase total yield in two ways. First, they harvest and utilize trees that would otherwise die from inter-tree competition. Second, the amount of growing space is increased for remaining trees. These latter trees grow faster than they would without thinning. In addition, because the trees favored with additional growing space in the thinning process are usually the largest and best-formed trees, the volume growth is concentrated on trees that will have the greatest increase in value. In general, the greatest benefits from thinning are obtained when it is started early in the life of the stand and continued on a regular basis.

The potential effects of thinning on oak stands are depicted in Figures 7 and 8. The earlier the thinning begins in the life of the stand and the better the site quality (as reflected in a higher site index), the greater are the increases that can be realized in total volume yield over time. In the past there have been few markets for cull trees, low quality trees, and trees smaller than 9 inches in diameter that result from thinning. Consequently, thinning (particularly thinning early in the life of a stand) has frequently been a management expense rather than a source of revenue from the harvested trees.

Figure 8 illustrates for thinned stands how the combination of volume from trees harvested during thinning and the increased growth on the remaining trees can substantially exceed the growth of unthinned stands. Thinning removes cull trees and reallocates their growing space to trees of better quality. In this example, the thinned stand was thinned to 60% stocking every 10 years beginning at age 30. Total volume yield for the thinned stand is the sum of two components -- the live trees that

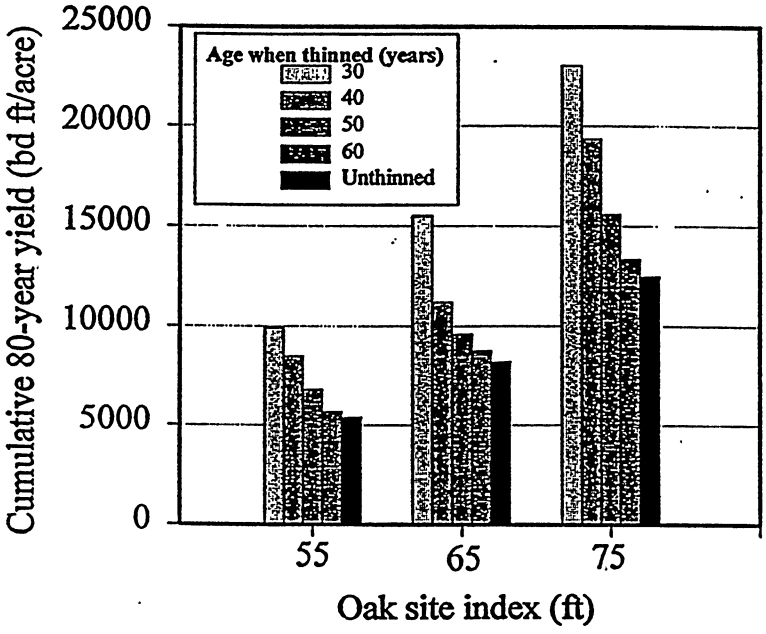

Figure 7. Effect of site quality and age at first thinning on cumulative board foot yields (cut volume + residual stand volume) of central hardwood oak stands. (Gingrich 1971)

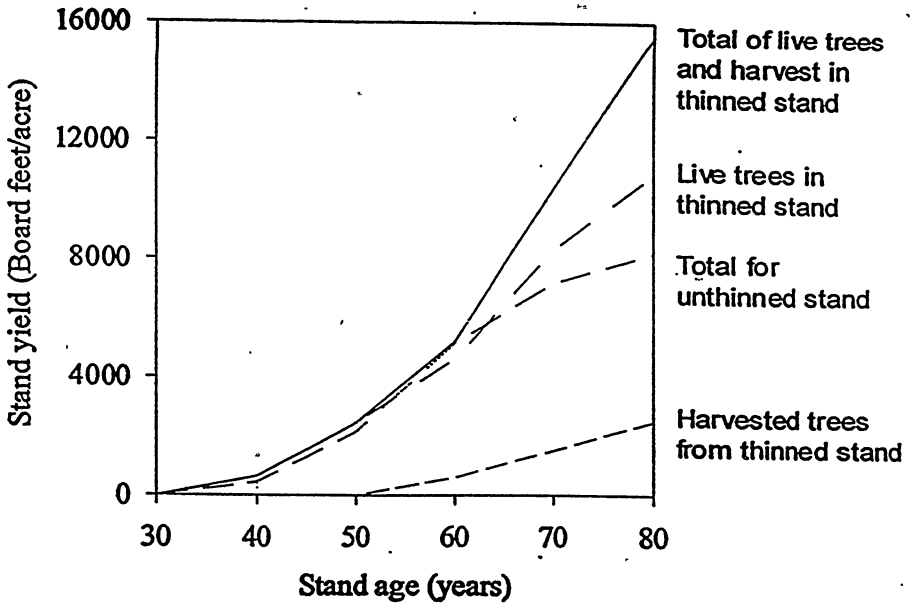

Figure 8. Live trees and harvest levels in thinned and unthinned stands. Based on a stand with site index 65. (Gingrich 1971)

remained after thinning and the volume of material harvested during the thinnings. Yield for thinned stand is nearly identical to the unthinned stand through age 50, but by age 80 the cumulative yield for the thinned stand is nearly double that of the unthinned stand. Given that one-third of the standing cubic foot volume in Missouri is in cull trees -- i.e, some 4.8 out of 13.8 billion cubic feet -- the opportunities to replace cull trees with growing stock trees through management are enormous.

The forest inventory analysis prepared for the Governor's Advisory Committee focused exclusively on cubic foot measures of forest growth and removals, because those are relevant to chip mill wood procurement. However, the changes in board foot volume between 1972 and 1989 provide further evidence of both the need and the opportunity to improve the value of private forestlands through management. Between 1972 and 1989, the total board foot volume of growing stock trees increased from 15 billion to 26 billion board feet (as estimated by the international 1/4" log rule). However, during this period the volume of timber in the highest two log grades actually decreased, while the volume in the lowest log grade increased by almost 10 billion board feet (Shifley 1999b).

This clearly suggests that forest management can be used to increase the volume of timber in the better log grades and, concurrently, the economic value of the forest products. In theory, by starting early in the stand's history and managing intensively, the growth in terms of board feet can be almost doubled by thinning out the lowest quality trees, utilizing them, and increasing the growing space and concentrating that growth on the highest quality trees. Thus increasing the intensity of management by reducing the number of cull can lead to much higher timber volumes and quality. One economic issue associated with this is how to pay to remove cull tree material. If chip mills provide such a

market, and if they actually utilize the vast amount of cull material potentially available, then a linkage between the mills and better management of Missouri forests could clearly be established. However, as noted earlier, the mere existence of a potential market does not necessarily imply anything about the kind of harvesting practices utilized to supply that market. Additional information is required to establish such a linkage. In that regard, the Governor's Advisory Committee requested and received an annotated bibliography "Potential Impacts of Chip Mills in Missouri" (Walter and Dwyer 1999) which contained an extensive set of references on economic and environmental impacts of harvesting practices which might be conducted in response to demands for chips and other forest products.

Sustainable Management and Private Forest Profitability

Among the many aspects of sustainably managed forests is the question of whether, even if sound management practices are applied, management of Missouri's private forestlands is an economically viable option for landowners over the long term. Fortunately, an active research project has been underway for some time which, among many other things, has addressed the question of the potential profitability of private forest management in the state.

The Missouri Ozark Forest Ecosystem Project (MOFEP), initiated in 1989 in southeastern Missouri, is a 9,200 acre long-term landscape experiment designed to compare the impacts of even-aged, uneven-aged, and no management on a wide array of ecosystem components. This large research project lies in and around the procurement area for one of the chip mills in question.

One of the components of the MOFEP project involved a complete forest inventory of both pre- and post-harvest forest conditions.. A team of researchers from the Missouri Department of Conservation and the University of Missouri-Columbia used these data to model the long-term economic outcomes of different harvest regimes over a 100-year period following the initial harvest (Dwyer et al. 1998). The growth and yield model used was the Forest Vegetation Simulator (FVS), the Central States variant (Bush, 1989). Data for the model included actual harvest levels and residual inventory.

The results of the economic modeling of the even-aged or clearcutting regime provide information on the potential impacts that clearcutting -- possibly in response to demands generated by the chip mills -- may have on the long-term profitability of private forests in Missouri. The results of the study show that even-aged management *can* generate net present values ranging from $24 to $40 per acre. According to the model, even-aged management can be economically sustainable over a 100-year period. This implies that long-term timber production can be an economically viable option for landowners.. In contrast, the results for the control (no management) sites ranged in value from $2 to $3 per acre in net present value. These differences in value between management and no management are attributable to management harvests which capture increases in growth and yield as well as mortality which would have been otherwise lost to production.

The above study considered only timber production and did not attempt to analyze other direct and indirect uses of the forest resource base. The economic parameters for the study included a 4% discount rate, an investment period of 100 years, and stumpage price figures published in the

Missouri Timber Price Trends market report. Natural regeneration was modeled using the ACORN (A Comprehensive Ozark Regeneration Simulator) model (Dey et. al 1996). The management regimes used were developed based upon current Missouri Department of Conservation forest management guidelines.

The Wurdack Farm, an outlying experiment station of the University of Missouri-Columbia, was the site for another study to develop a management plan for the property which would produce a sustainable yield of merchantable timber (Trammel 1991). The farm is located in the Eastern Ozark region of southern Missouri. The topography is comprised of narrow, stony ridges suitable for growing timber, and valleys suitable for forage crops. This is typical of many of the farms in this region. This study compared the economic returns of even-aged (clearcutting) versus uneven-aged (single-tree) management. Results indicated that either management method can yield suitable returns to the management of the oak-hickory forests found on this property. Furthermore, this study found that either even-age management with provisions for natural regeneration, or uneven-age management using a 20-year harvest cycle with provisions for natural regeneration, will yield the highest returns to management at real discount rates between 2.0 and 7.0 percent and stumpage prices between $80.00 and $100.00 per thousand board feet (mbf).

In view of the extensive discussions concerning even-aged management (i.e., clearcutting) that have accompanied the 'chip mill issue,' it is worthwhile to take note of one of the longest sustained efforts at uneven-aged management that has been occurring in Missouri for several decades. Pioneer Forest is a large and privately-owned forest of nearly 160,000 acres in southeast Missouri that was established in the 1950's to demonstrate the long term benefits of sustainable forest management using a method of uneven-aged silviculture known as single-tree selection harvest.. Ongoing efforts at Pioneer hope to demonstrate the benefits that are possible from a well-managed uneven-aged Ozark forest, including economic returns, restoration of forest landscapes, protecting significant species diversity and natural communities, and providing ongoing recreational opportunities. To help accomplish the above, a continuous periodic forest inventory has been conducted on Pioneer lands since 1952, measuring various components of the forest such as species diversity, as well as tree characteristics such as height, diameter and condition. This has provided a wealth of data for systematic research relating uneven-aged silvicultural techniques to timber yields and potential profitability which began in the mid-1980's and promises to strengthen the knowledge base on this important type of silvicultural approach.

In the Wurdack study noted above (Trammel 1991), market prices for timber were assumed to remain constant over the period of the study, thereby limiting the practical application of its results to some degree. A recent study compared even- and uneven-aged management regimes over a 24-year period (1975-1999), while taking market price changes and inflation into account(Iffrig et al. 1999). The results indicated that substantially greater returns per acre were realized with the uneven-aged regime (two selective harvests over the period) when contrasted with an even-aged regime in which the stand

was clearcut at the beginning of the period and the income invested at a 5% rate of return[12]. The results of this study do highlight the fact that uneven-aged management can be profitable for private forestland owners in Missouri. In terms of landowner motivations to adopt such techniques, this will be most valuable for those to whom frequent, periodic returns for timber harvesting and the nontimber values of the forest ecosystem are of primary importance. Moreover, with the turnover rate for an average acre of nonindustrial private forestland (NIPF) in the state recently identified as 28 years, uneven-aged management does not require a land tenure period extending the length of an even-aged rotation in order for the landowner to realize a profit from his or her timber. This could be significant when contrast to the prospects for immediate returns to owners from clearcutting for chip mills, owners who may give little thought to the greater per acre returns that could be realized at the end of a 60-year rotation.

It is evident that much more research is needed in order to better understand the potential profitability of timber harvesting on Missouri forestlands. Nonetheless, on an overall basis, the results of these studies provide some evidence that managing Missouri's private forests for timber can be profitable using either even- or uneven-aged management regimes when conducted in a manner conducive to sustainable forest management.

Chip Mills and Sustainable Private Forest Management

The effects of chip mills on the possibility of enhancing sustainable forest management in Missouri must be assessed in the context of the history and management of private lands in the state. As noted earlier, despite their many virtues, Missourians are not especially renowned for superior forest management. At the same time, it has been mentioned that the chip mills may provide a potential market for an abundant 'cull resource' that reflects a history of poor forest management in the state. Whether such a pattern of management continues in supplying the chip mills themselves, however, is a topic of major concern.

It is worthwhile, therefore, to briefly consider the array of possible outcomes in terms of management practices that could be adopted by landowners in response to the demand for chips. In a study in Arkansas, Guldin (1999) constructed a 'scale' of five possible outcomes of chip mill harvesting (Table 7) -- that is, harvesting conducted in response to demands generated by the mills, and in which the wood harvested was for chip mill consumption. A landowner would be at the 'top' of the scale if he or she selected the 'best possible outcome' when having their land harvested for chips.

The best possible outcome would occur when the harvests were used to thin growing or mature stands, remove the cull material, and open up the stand to allow for accelerated growth of the remaining higher quality trees. The second best outcome would involve clearcutting, removing the

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[12] At the end of the 24-year period, the value of the timber volume on the tract which had been clearcut at the beginning of the period was recognized, although the actual value of the forest product increment was considered to be negligible. Some analysts believe that this aspect of the study should be re-examined.

Table 7. Scale of five possible outcomes of chip mill harvesting. (Guldin 1999)
*** Practicing sustainable forestry => Best possible outcome ***.

1) *best possible outcome* : Harvests used to thin hardwood pole timber or sawtimber stands where the worst trees were cut and the best trees remain

2) *second best outcome* : Clearcutting the stand with a follow-up treatment to remove the cull material and the undesirable species left behind, with the primary goal of letting the oak component re-sprout with optimal competitive advantage.

3) *third best outcome* : Clearcut harvest with follow-up treatment, and planting pine.

4) *fourth outcome* : Harvest with no follow-up treatment -- stand reverts to poor quality hardwoods.

5) *least desirable outcome* : Conversion to pasture; commercial forest area is removed from forest cover.

cull material in the process, and 'cleaning up' the site to allow a healthy oak stand to regenerate from stump sprouts. Very little residual stems would be left here except in the stream-side zones and the wildlife den trees. This represents an instance where clearcutting can be a valuable management tool, especially if the stand is of such low quality overall, with not only cull but poor quality larger trees as well. In cases like this, it can be best from a silvicultural standpoint to 'start over' and actively manage for a healthy stand.

The third best outcome would again involve clearcutting, but in this case re-planting the site with pine. This might be a sound management practice for some Ozark sites on south- and southwest-facing slopes. Here site factors may work against development of a productive hardwood stand. In such cases, 'starting over' and converting to pine, which can accommodate better to such sites, may be the most effective way of enhancing forest sustainability. Planting is important here for stand establishment.

A fourth outcome might be a harvest, most likely a clearcut, with no follow-up treatment. In this minimal management scenario, no effort is made to influence the development of the stand subsequent to harvest. With no effort, little can be expected in terms of the growth that does come back. One variant of this poor outcome would be the case where, despite the fact that there are trees left on the site, the future developmental dynamics of the site are now in the hands of hickory and red cedar. Finally, the least desirable outcome along this scale would occur when the stand is clearcut and the land is converted to pasture. As opposed to 'management,' this outcome is basically forest liquidation. The land is simply cleared and converted to a non-forest use.

In the above study in Arkansas, which focused on two mills that exported all their chips out of the state (and thus a very small segment of the overall chip mill industry in the state), Guldin found that outcomes 4 and 5 in Table 7 constituted 90% of the options selected by landowners in supplying wood to the chip mills. He concluded that the best possible outcome listed above involves the kind of treatment that chip mills, because of their innate economics, generally don't do or encourage in Arkansas. With respect to such kinds of thinning operations, it takes very careful logging supervision to avoid having the more valuable small saw logs not damaged as a result of the logging. As a result, in relating chip mill demand to harvesting practices that occurred on private lands in response to that demand, Guldin concluded that in the large majority of cases the harvesting for the chip mills was not good forestry.

The dearth of other studies directly linking chip mill demand to on-the-ground practices on private lands in response to those demands makes it unwise to generalize from this instance to a broader conclusion encompassing all NIPF lands. It does suggest, however, that with respect to the situation in Missouri, and given the history of poor forest management on most private lands even prior to the arrival of the chip mills, that even having an adequate supply of wood in Missouri forests *and* concrete evidence that forest management can be profitable for private landowners -- important as these aspects are -- may not be sufficient by themselves to lead to sustainable forest management on the state's private forestlands. Other factors, particularly those linked directly to motivations of landowners to manage their lands, must evidently come into play for this to happen.

C. SUSTAINABLE ECONOMIC AND SOCIAL IMPACTS

The previous section contained two perspectives of some of the key ingredients of sustainable forest management. One of these, the Sustainable Forestry Initiative of the American Forest & Paper Association, was oriented primarily to on-the-ground management activities that would contribute to sustainable forestry (Table 6a). The perspective of the Forest Stewardship Council (Table 6b) was somewhat broader in nature. One feature that stands out about the latter is that half of the management principles for sustainable forestry focus on people, as opposed to the forest *per se*. From respecting rights of indigenous peoples, as well as property rights in general and existing laws that reflect important societal values, to assuring the more general use of the wide variety of forest products as a means of enhancing economic and social (in addition to environmental) benefits -- all of this implies that sustainable forest management is not simply about forests, but about people as well.

This points to a second theme within the last section. If people have evolved within, and by their actions both affect and are affected by the complex ecological web that has traditionally been referred to as the 'natural environment,' then sustaining the well-being of that ecological web *inherently* entails sustaining the social, economic, and psychological well-being of the people who are a part of it. While this does not preclude speaking in terms of cause and effect relationships between humans and their 'environment' (e.g., 'the weather affect people,' 'people pollute the environment,' etc.), this should not be allowed to mask the fact that human and environmental health and well-being are interdependent parts of the same ecological system. In this light, it makes perfect sense to recognize, as does the Governor's Advisory Committee (see figure in introduction to Section II), that a sustainable forest resource base and its management both contribute to and are dependent upon a sustainable environment and sustaining the social and economic well being of people. While it remains practical to discuss each of these latter ideas separately -- as is done in the next two sections on "Economic and Social Sustainability" and "Environmental Sustainability" -- their interdependent roles in this complex ecological web is a basic assumption underlying all that follows.

The economic impacts of chip mills are experienced in a variety of ways. Direct impacts are felt in the number of jobs the mills create and the income earned by those occupying such jobs; as well as in the value of the products the mills produce as inputs to further economic activity within the wood products industry. Such impacts are also experienced in the income derived by landowners who sell wood to the mills and loggers who harvest the timber. That process will in turn be structured by the markets created by the mills to which landowners and loggers respond. Another set of impacts is manifest in the effects of the chip mills' economic activity on other firms in the wood products industry, especially those that are capable of utilizing wood processed by the chip mills in the manufacture of higher-value products. Further economic impacts are felt indirectly by other industries dependent on the status of the forest resource that will be affected by supplying wood to the mills. Among these, the outdoor recreation and tourism industry is among the most prominent; and this in turn is closely linked to the overall environmental effects stimulated by the demand for

chips. All of the above merit some attention when considering the current and potential economic impacts of the chip mills in Missouri. Finally, it is important to recognize that in addition to economic impacts, a wide array of broader social consequences -- not the least of which are new challenges and opportunities for collective action to ensure sustainable forest management in Missouri -- will emerge from the 'chip mill issue' in the state. Some of these will also be briefly considered later in this section.

Hardwood Markets and Sustainable Management

A first point of interest centers on the fact that in order to 'plug into' the forest products sector of the local, regional, national, and international economies, the chip mills require inputs for their production process. This creates a demand for those inputs and in the process establishes a market for (in this case) harvested timber. Keeping in mind the vital linkages between chip mill demands and forest practices conducted on the ground to meet those demands, a first question that naturally arises is : What kind of hardwood market created by the mills would produce the best results in terms of the forest practices employed to meet that demand? Alternatively, what would an ideal hardwood market look like, where "ideal" signifies that it would allow landowners to take maximum advantage from a profitability standpoint of employing sound management practices to enhance the sustainability of their forestlands? The characteristics of such an ideal hardwood market were described by Guldin (1999) as part of his study on export chip mills in Arkansas that was introduced at the end of the last section. These characteristics may be found in Table 8.

Table 8 . Characteristics of an ideal hardwood market (Source : Guldin 1999)

1) It would be *open to large, rough and rotten trees* that are unsuitable for sawlog products.

2) There would be *no limits on the species taken.* All hardwood species could be used.

3) It would *take pulpwood and tops from sawtimber thinnings*, especially at volumes that would be inoperable if not for the fact that sawtimber were being cut.

4) It would *take pulpwood and tops from hardwood-pulpwood thinning.*

An 'ideal' chip market would first of all accept large cull trees. Moreover, all species -- down to 5" diameter breast height, the smallest wood generally taken by the mills for processing -- would be accepted. This second criterion reflects the fact that when 'undesirable' species are left behind, subsequent stand dynamics and, ultimately, forest productivity, can be affected adversely. Thus, for example, if hickories and red cedar were not harvested due to their undesirable characteristics in terms of utilization for chips, a tract that could have been regenerated into an oak-dominated forest would likely be converted into a hickory- and red cedar dominated-forest, which has far lower value

in terms of both timber and a variety of non-timber forest benefits.

Thirdly, the ideal market would accept growing stock (and cull) from thinnings of sawtimber stands. As a rule, the smaller trees in these stands are the runts of the litter. Removing them can expand the crown space of the dominant trees, increase photosynthetic capacity, increase mast production, and increase log size. An important corollary here is that an ideal market would accept this material even for relatively small volumes that might be produced from thinnings of stands on individual tracts. This reflects one of the critical economic factors that intervenes in the linkage between standing timber and actual utilization of timber supply. For given the large number of relatively small tracts of NIPF lands in the state, it is often simply economically impractical to haul relatively small volumes of thinned materials from a tract to, for example, a chip mill. The transportation costs, when combined with those for conducting the thinning operation itself, would exceed the income generated from the sale of the thinned material to the chip mills. As a consequence, trips to the chip mill are likely to occur far more frequently not with *thinnings*, but at the point of final sawtimber harvest. But as was evident in Section II, in many cases it is the intermediate thinnings that can contribute to much greater volumes *for* that final harvest. In short, an ideal hardwood market would provide a source for all thinnings on all tracts at all stages of stand growth.

The fourth characteristic of an ideal market for chips highlights the fact that it would be most beneficial to conduct thinnings in pulpwood-sized hardwood stands just as they are developing into sawlog hardwood stands. This would be a most valuable tool to increase the productivity of hardwood sawtimber. Moreover, this in turn would increase hardwood mast production, thereby providing a way for oaks to mature from medium- to large-sized trees with all of the attendant benefits in terms of timber, wildlife, recreation, aesthetics and water, that result from such a process.

In examining the markets actually created by the chip export mills in Arkansas, recalling again that this is a very small segment of the overall chip mill industry in the state, Guldin found that they do indeed take a certain measure of rough and rotten material, thus satisfying the first of the four ideal market characteristics. With respect to the second criterion -- i.e, that all species are taken by the mills -- this does not appear to be the case for the export mills in Arkansas. These mills do not take hickory, which is very difficult to debark. Nor do they take red cedar, which is another important component of Arkansas forests.

When it comes to providing an opportunity to thin the pulpwood from sawtimber stands, the export chip markets did not meet this criterion. Guldin describes the typical scenario in Arkansas that he observed. A chip mill procurement forester, when comparing a particular tract on which only small trees could be taken to an adjacent tract where the landowner was placing *no* constraints on the trees taken, will always attempt to procure the wood from the latter. The economics of the situation dictate the choice. And so for market scarcity considerations, thinning the pulpwood from sawtimber size hardwood stands seldom if ever occurs in Arkansas, or if it does, it occurs for only about one out of every twenty harvests.

With respect to the fourth criterion, i.e., whether the export chip market provided an opportunity to

thin the hardwoods in a hardwood/pulpwood-size stand, the answer was 'no' for the same reasons as above. It was simply too easy to find landowners who did not want to constrain immediate yields from harvests by requiring that, for example, a hundred of the better quality trees be left per acre. From the perspective of a wood procurement forester obtaining a supply of wood for the mill, other economic *dis*incentives further contribute to discouraging a thinning-type harvest, and thus meeting the last two criteria in Table 8. This kind of harvesting can require a different configuration of equipment than some contractors have. It requires machines that are more nimble in the woods. It requires a more careful operation by the equipment operators in order to avoid doing damage to the residual trees and then dealing with a dissatisfied landowner as well. It means that harvesting a 40 acre block, for example, would require more time on the part of the operator to do a careful job relative to the volume per acre being removed. Harvesting that leaves a hundred of the best trees in the stand, as opposed to removing all commercially valuable material, brings a lower per acre value at *that* point in time. (As demonstrated earlier, this is clearly not the case from a longer time perspective.) So for all of the above reasons, the incentive for the procurement forester is that if there are two areas of similar capacity available for harvest, and one has constraints on it and the other does not, the site without the constraints will undoubtedly be cheaper to log, and will also bring the higher profit.

In summarizing the experience of export chip mills in Arkansas, Guldin concluded that these mills have not provided the market to do the kind of hardwood thinning that it was hoped they would be able to provide. Although rough and rotten trees are taken, some species such as hickory and cedar are not taken in Arkansas. Pulpwood thinning from below is impractical; and together with the variety of economic reasons noted above, the overall result is that the market falls far short of what would be considered ideal.

As noted in discussing Table 7, the limited scope of the Arkansas study suggests caution in inferring broader behavioral patterns. So just as with the situation involving landowner forest practices in response to chip mill markets, whether this will be the case in Missouri is uncertain. Again, however, this conclusion suggests that the link between a market for wood chips and better forest management may indeed be tenuous -- *this* time due to mill restrictions on wood inputs and lack of encouragement by the mills for practices which, while leading to better forest management, would serve to reduce the volume immediately available as inputs to chipping operations.

Chip Mill Interactions with Landowners and Loggers. When purchasing wood from landowners or loggers, or hiring the latter to harvest timber already purchased, the chip mills participate in the wood products market as a consumer of timber and logger services.. There are four basic modes through which timber is procured by the state's two chip mills.[13] First, a landowner may contact the mill and ask its representatives to come out and provide an estimate of how much the mill would pay for a certain acreage of trees. Secondly, a landowner -- or a forestry consultant or forester from the Missouri Department of Conservation acting on behalf of a landowner -- may send out a call for bids on a particular tract of timber. Thirdly, a timber procurement officer for the mill may cruise the local

[13] The primary source of information for this discussion of chip mill transactions is Hirt (1999)

area, note tracts with the aid of ownership books, go to the courthouse and find out who owns particular tracts of interest, and contact the respective landowners to see if they are interested in selling timber. Finally, loggers may bring wood to the mill site; such wood is referred to as *gatewood.*

The majority of the timber in Missouri is bought from landowners by loggers and then taken to the mills. Most loggers work within a circular area of within 30 to 35 miles and become acquainted with landowners within that area. The origin of wood procured by the mills can, however, vary substantially over a given period of time. Thus, for example, at the Canal Industries mill at Scott City, in 1999 the percentage of wood that was gatewood -- i.e., brought to and purchased at the mill -- was about 50% in January and only 10% in June. The remainder was controlled stumpage -- i.e, wood purchased under timber contract from a landowner or his/her representative.

When buying timber from a landowner, the chip mill enters into a contract with that individual. Contracts are written to provide protection for both the landowner and the mill during the life of the transaction. Contracts may have specified provisions for adhering to state and federal regulations, plus any other addendums that are acceptable to the two parties -- e.g., requirements for restoring roads, the use of best management practices, etc.

At the Canal Industries mill in Scott City, contracts for wood purchases take the form of either a lump sum or 'pay-as-cut' contract, with the prices agreed upon by both parties). In essence, the contract is a timber deed involving the landowner and the mill. For a lump sum contract, the buyer (here, the chip mill) is given title to the trees; thus by virtue of the timber deed the chip mill owns the timber. If the contract is of the 'pay-as-cut' form, the landowner actually maintains the title to the trees until they are harvested. It should be noted, however, that entering into a lump-sum contract does not prevent the landowner from selling the land while the timber deed is still in force and before the timber has been harvested. This does happen occasionally, and it can cause obvious problems for the new landowner who, while possibly knowing that some sort of timber deed exists, is not aware that he or she no longer actually owns the timber. The timber procurement specialist for the chip mill -- who is generally a trained forester -- also checks every tract of timber purchased for liens or encumbrances that could tie up that timber's value. In cases where these exist, the mill would have to obtain a release from the lien holder in order to buy the timber.

The chip mill puts together a logging plan for any such timber purchased on private land. Elements of the plan may include how the tract will be logged, when the roadwork will be done, and identification of SMZ's (streamside management zones), which are buffer areas adjacent to streams that are not harvested. Other environmental concerns such as springs, hazardous waste sites, endangered species, etc., may also be considered in the plan.

After the timber rights have been purchased, the chip mill then hires loggers as independent contractors to harvest the site. The mill's contract with the loggers may contain provisions specifying actions that must be followed to meet certain objectives of the landowner. The procurement forester who buys the tract supervises the logging and generally visits the site frequently while the operation is in progress. This individual also supervises closing the sale out. It is generally preferred to have

as much of the closure work as possible performed by the logger; but some activities cannot be accomplished with a skidder, and the mill may bring in larger equipment if required.

In light of the above, it is evident that depending upon the method of wood procurement, a chip mill has more or less opportunity to influence the kind of forest management employed on private lands in supplying timber to the mill. In those situations where the mill contracts with the landowner, whether initiated by either party or in response to a call for bids, there is ample opportunity to incorporate sound forest management for chip harvests into the harvest plan. Whether this involves informing the landowner that there may be other options than, for example, clearcutting for chips and that these can be profitable, is entirely another matter; and the kinds of economic concerns and responsibilities of the procurement forester would seem to weigh rather heavily against this. In a similar vein, the chip mill has the opportunity to ensure that the logging crews they hire meet certain requirements such as, for example, harvesting with the use of best management practices. Canal Industries states that they do require such practices of their loggers. The verification process is, however, exclusively internal.

On the other hand, in purchasing wood at the gate, the chip mills do not have the same *kind* of opportunity to directly influence forest management practices that were employed to harvest that timber. The mills could, of course, insist that all wood be brought be harvested with the use of best management practices. This would require, however, some sort of verification component or option. On an overall basis, the potential for exercising social responsibility on the part of the mills in contributing to sustainable forest management via the timber procurement process varies with the sources of the wood. Recognizing the economic imperatives of any such firm, the extent to which sound forest management is actually practiced in supplying wood to the mills depends at this point -- and to the extent the mills can influence that process -- on a process involving good faith and social responsibility on the part of the mill forester supervising the operations embedded within a monitoring and/or verification system that is exclusively internal to the mill operations.

Economic Impacts of Chip Mills : Forest Products and Tourism Industries

When considering the current and potential economic impacts of the two chip mills in Missouri, several kinds and/or levels of effects are relevant. On the one hand, the mills generate direct economic impacts on Missouri's economy in terms of the value of products produced, employment and income generated in that process, the income derived by landowners who sell their timber to the mill and, directly or indirectly, the loggers who harvest the wood. The economic activities of the mills also affect other segments of the state's wood products industry. Of particular interest here are those small- to middle-sized firms that might serve as alternative potential consumers of wood inputs going to the mills. Especially important here are those firms that manufacture higher quality 'value added' wood products. The chip mills may also impact the economic performance of other industries in the state dependent on the status and health of Missouri's forest resources as 'inputs' for goods and services other than wood production. Foremost among these is the state's outdoor recreation and tourism industry.

At the present time, assessing both current and potential impacts of the state's two chip mills is an extremely difficult task, especially given that the mills have just become operational within the past three years. Data on production levels is extremely scarce, and only limited and often anecdotal information is available on employment and trade effects. Trend lines for any of these variables are only beginning to be established. This is also an area in which there is very limited data from other states. This has been recognized, and efforts are underway in some states (e.g., North Carolina) to remedy this lack of information on economic impacts of the chip mill segment of the wood products industry. However, results of that effort and others like it (e.g., in Virginia) will not be available until later this year.

Given the above constraints, the following discussion blends the limited information available with a variety of points raised during the course of the hearings conducted by the Governor's Advisory Committee in considering the impacts of the chip mills on Missouri's economy. There the attention centered as much around what such impacts *might* or *could* be as on what they have actually been during the short period in which the mills have been operating. In doing so, attention is given to certain more general considerations that are relevant to the present day 'chip mill issue' in Missouri. This cannot replace, however, the need for further, more systematic research that is required on this subject, along with the resources needed to support that research.

Chip Mills and the Forest Products Industry. The forest products industry is an important component of Missouri's economy. It ranks in the top half of manufacturing industries in the state, encompassing about 6% of the state's manufacturing work force. The industry employs 25 thousand workers with a payroll of in excess of $680 million. In 1996, there were approximately 500 primary processors in the wood products sector of the industry -- i.e., those firms that manufacture a product from previously unprocessed raw materials such as logs or bolts (Jones et al. 1996). In addition, almost 600 firms were listed in 1995 as secondary wood processors -- i.e., firms that produce finished or semi-finished products from a previously manufactured raw material (Jones et al.1995).

The direct economic impact of chip mills is experienced in the value of the products they produce, the employment and income generated by their operations, and the nature and pattern of trade generated from their activities. The two mills themselves have together generated a very modest number of jobs -- less than 40. Added to that, of course, are the secondary impacts of logger employment stimulated by the demand for chips. While hard numbers with respect to overall production are difficult to obtain, in terms of trade all of the chips generated by the two mills are exported to out-state pulp and paper mills for processing. Missouri itself has no such facilities.

Under current permitting conditions, the Willamette facility at Mill Spring is currently limited to debark and produce 300 thousand tons of wood chips per year, although at present operations are structured to yield an output closer to 200 thousand tons. As of December 1999, the mill had been running one shift (i.e., operating at average capacity), although a three-shift regime (full capacity) is possible. Chips are stored temporarily and then shipped by train and truck to Willamette's paper mill in Kentucky, where they are pulped, bleached, and made into paper or cardboard boxes. The Canal

Wood facility at Scott City expects to process approximately 350 thousand tons of chips per year, virtually all of which is exported to Japan. As of December 1999, the mill was structuring its operating at average capacity (with occasional ten-hour shifts).

The Mill Spring facility employs six people, and wood is purchased from as many as 50 independent suppliers. Some may deliver volumes such as five tons per week; others may deliver five tons per month. The Canal Wood mill at Scott City employs approximately 20 people, half as wood procurement specialists and half as direct mill employees (Hirt 1999). If the mill were to run two shifts, which it generally does not, this latter number would increase by four or five employees. The mill works primarily with six logging crews, three of which operate on the Missouri side of the Mississippi River. In total, about 29 loggers are employed in these crews.

With respect to the income contributed to the economy by the chip mills, the canal facility may provide a brief sketch (Hirt 1999). In August of 1999, the mill's payroll for loggers totaled approximately $38 thousand. Assuming that loggers on average spend 80-90% of their income locally, this would translate into a contribution to the local economy of about $2 million per year. A rough estimate of the mill's annual contribution of income to landowners for providing pulpwood to the mill would be about $1.7 million. (This assumes that the mill is producing 350 tons of chips per year). For many of these landowners, the mill provides a market for pulpwood that had previously been worth fairly little except as scrap. In addition to the above, the Canal facility estimates that it paid $1.5-2 million to landowners for additional 'side' products such as tie logs, grade logs, and pine logs/pulpwood. On an overall basis, with the mill operating at average capacity and producing its anticipated output of 350,000 tons of chips per year, all of the above would translate into a contribution to the Missouri economy of about $6 million per year.

The above figures represent a recent estimate by one of the two high-capacity chip mills in the state of its expected contribution to the state economy. A recent internal report by the Missouri Department of Conservation (MDC 1999a) provides a tentative cost-benefit analysis for the potential annual contribution to the state economy of a *300* thousand ton chip mill. This analysis was based on methodologies employed by Gray & Gulden (1997) and the Tennessee Valley Authority in Tennessee (TVA 1993). The report summarized its analysis as follows.

> Missouri could expect direct benefits of between $1.8 million and $4.6 million per year from a single 300 thousand ton chip mill, and $1.4 million and $6.5 million in indirect benefits, for a total of between $3.2 million and $11.1 million per year. These numbers, if one accepts the methodology of the Tennessee and Arkansas studies, capture all the benefits to nonindustrial private forest landowners of the new market, as well as all other direct and indirect market benefits.
>
> Based on the literature available from other states and taking some large assumptions regarding places, times, and situations, a chip market in Missouri could yield potential benefits of $3.2 million to $11.1 million, and costs from $1.5 million to $10.5 million. Recall that "costs" here should include all losses to society : recreation,

bequest (forests for our children), future option, irreversible biological loss, and anything else the public may value, but not find a market for, in Missouri's forests. Given the uncertainties and methodological problems associated with the estimation of benefits and the hypothetical and inferred nature of the estimation of costs, the result is slightly positive, but probably statistically too close to call.

The above discussion again highlights the fact that at this point in time there is a great deal of uncertainty regarding the potential costs and benefits of chip mills in Missouri; and that a focused analysis to more directly address these questions should be an important research priority.

With respect to employment, one concern regarding the chip mills, but also characteristic of most resource-extractive industries, is the low number of jobs they create relative to those provided by the aggregate of secondary processors of wood products. This grossly disproportionate relationship for wood products in general is illustrated in Table 9. When considering jobs created per million board feet of timber, it is evident that jobs produced by secondary processors producing high quality or

Table 9. U.S. Employment Created by Various Timber Products (Source : Mater 1998)

Process	Additional jobs created
Logs to lumber	3 jobs per million board feet
Lumber to components (e.g., furniture parts)	Another 20 jobs per million board feet
Components to high-end consumer goods (e.g., furniture)	Another 80 jobs per million board feet

value added products dwarf those generated by extractive processors.[14] This also illustrates a more general idea that the way to higher profits is not always necessarily through increasing the volume of wood cut or processed, but may be through producing higher value products. More (and often higher skilled) jobs are created per unit of wood in value-added processing than in less labor intensive areas such as logging and chip mills. Both workers who make their living from the forest and the communities in which they live gain, because both forests and the jobs will be sustained.

With respect to the 'chip mill issue' in Missouri, concerns involving the above revolve around the kind of wood that is processed by the mills; and whether or not some of the logs going through the

[14] **Value added** may be technically defined as the difference between the sale price of the goods sold and the cost of materials and supplies used in production (Klemperer 1996).

mill could yield more economic value -- in terms of both products and jobs and income -- if they were utilized by value-adding secondary processors to make products such as furniture parts or furniture, finished lumber and millwork, flooring, paneling, and so on, as opposed to being run through the chipper. A second interrelated concern is whether the demands generated by the chip mills, and the concurrent wood flows to meet those demands, will adversely effect the survival of any or all of the small secondary wood processing firms in southeast Missouri.

The question of 'what is going through the mills' has been one of the more vexing ones for the Governor's Advisory Committee throughout the course of the hearings. It is central to a number of the concerns involved in the overall 'chip mill issue.' In section A it was shown that Missouri has an extensive volume of cull material in its forests; and in section B it was further pointed out that good forest management, which would in part involve removal of cull material, offered an enormous opportunity to increase growth and enhance forest sustainability. The chip mills were also seen as providing a viable market for that cull material. The solution would be complete, therefore, if the mills were processing primarily cull material, or at least substantial quantities of it, and in the process not taking the higher quality trees, which would then be available for value-added processing. Again the answer lies in what is going through the mill.

As with many aspects of this issue, the answers offered have been mostly anecdotal in nature. There is some evidence that what is being chipped by the two major mills in Missouri contains a lot of wood for which there is a better use. At the same time, on a statewide basis and with the usual caveats on making specific inferences from such broad figures, if about one-third of the standing material in Missouri forests is cull, then when an acre is clearcut, two-thirds will be growing stock, and within that there will likely be some bigger and/or better quality trees. In his Arkansas study, Gulden observed that the chip mills will understandably encourage the cutting and removing of what they feel they can utilize. He noted that most of the stands in Arkansas that the export chip mills were harvesting did have some sawlogs in them; and that the chip mills were not paying the landowner the sawlog value for the sawlog component, but rather buying all the standing timber on the site for a bulk price. He also observed that some of the chip mills had such contract concerns that they essentially chipped sawlog material; while others were sorting out the sawlog material and reselling it to a hardwood sawmill at a much higher price. From a particular mill's perspective, both existing markets and outstanding contracts will in part dictate the mill's action. In the latter instance, for example, if there is pressure on a mill to fill a large order for chips by the following month, then everything that goes through the mill is going to be chipped.

As is the case with many facets of the 'chip mill issue,' the Governor's Advisory Committee is faced with estimating the significance of this question and adopting a range of actions -- from doing nothing and hoping for the best to articulating some sort of "gatewood policy" which itself could involve anything from encouraging or mandating that mills buy only from certified loggers to imposing requirements that a certain percentage of processed wood be low grade material. Whatever the conclusion is, it would likely reflect the view that in purchasing wood the mills should have to assume some responsibility for where the wood comes from and for the actions of the wood suppliers.

The potential impacts of the chip mills on small firms in the secondary wood processing segment of the industry will, of course, depend in part on how the above question of what goes through the mill plays out over time. However, these markets have been volatile for some time, well before the chip mills arrived. Thus while the chip mills will likely encourage some competition, which may contribute to driving some mills out of business, at this stage it is unlikely that they will be the sole cause for these firms exiting the industry. However, depending on the kind of wood utilized by the mills, over time a continued use of high quality wood by the chip mills could intensify the volatility of the secondary wood products market to a greater degree than would have otherwise occurred.[15]

Chip Mills and the Tourism Industry. Tourism continues its rapid growth and strong position as a major force in national, state and local economies. A 1994 estimate by the U.S. Department of Commerce of the impact of tourism on the United States economy states that the tourism industry produces 13.4% of the national GNP, employs 11 million people, and generates more than $50 billion in tax revenues (Lundberg et al. 1995). Correspondingly, this national impact plays itself out at the state level. Through the first three quarters of the fiscal year (July 1998 - March 1999) domestic tourists and travelers in Missouri spent an estimated $4.1 billion, up nine percent from the first three quarters of FY98 (Kaylem 1999). Demographic and psychographic indicators, as well as discretionary growth measures, all predict continued demand for tourism services across a wide spectrum of travel and recreation activities. Every state engages in marketing its natural, cultural and socio-economic landscape as a potential destination worthy of tourist visitation and subsequent expenditures. Missouri is no exception in taking a pro-active stance to compete for an increased share of the tourism market. Tourism is often proclaimed to be the state's second largest industry.

Within the broad tourism spectrum, natural resource based tourism (often referred to as nature-based

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[15] In this discussion of the potential impacts of chip mills on the 'wood products' industry, it is worthwhile to briefly make note of the fact that forest land can be a source for a multitude of products in addition to sawlogs, veneer logs, pulpwood, or firewood. Throughout time, man has learned to utilize the majority of plants located within a forest environment to aid our everyday living. Wild edibles, medicinal plants and pollen, dyes for our clothing, decorations for our homes, materials for baskets and other containers, extractives for chemicals and liquid fuels, materials for carving and art-work, materials for making bows and arrows and other weapons....are but a few of the thousands of usable products historically linked to forests (Jones 1999). However, modern forest owners have many opportunities to market a mix of these very same products into economies extending from the local area to the global community.

Alternative forest products offers nearly every forest landowner, large or small, opportunities for realizing annual income from the sale of these types of products. Involvement need be no more rigorous than selling the right to harvest natural products to individuals who collect, process, and market goods or services in the progression toward the consumer. If forest landowners desire to be involved in adding value to their own raw products, thus realizing more income, those possibilities also exist. Alternative forest products can provide the monetary returns annually or in the short term that will allow private landowners to afford long term commitments necessary to produce good sawlogs and veneer logs. It seems logical that landowners who educate themselves in the niche market opportunities of alternative forest products are more likely to discover the uniqueness of a forest environment and desire to sustainably manage it for the long term. In this light, alternative forest products can be a key to development of better management for privately owned forests in Missouri and elsewhere.

or eco-tourism) has reported the most rapid growth rate within the industry. This subset of the tourism array often includes more passive or less consumptive recreation experiences, which are dependent on a sustainable natural resource base as a prerequisite to a quality experience. Outdoor recreation activities such as wildlife and scenic viewing, photography, camping, trail hiking and biking, and historical and cultural education require that ecosystem variables of forests, prairies, wildlife habitats, rivers and streams provide the 'product' that outdoor recreation enthusiasts seek. Although potentially less consumptive (and often termed 'passive') in nature, these leisure pursuits accentuate the serious business of recreation. From the perspective of the U.S. Forest Service, for example, recreation has been identified as a central component of its economic future (Annin 1999). In part this reflects the trend that nonconsumptive recreational activities are growing in popularity relative to traditional outdoor recreation pursuits (Duffus and Dearden, 1990). The number of people who travel primarily for passive wildlife recreation increased at an average annual rate which exceeds all other wildlife-oriented recreation (Knight & Gutzwiller 1995). Missouri's current tourism theme, "Where the Rivers Run," portrays the unique natural resource base Missouri possesses for such tourism experiences.

Due to its distinctive landforms and scenic qualities, South central Missouri is the locus of a significant portion of the 15% of forestlands in the state under public ownership. The Mark Twain National Forest, as well as parts of the National Scenic Riverway System, state conservation lands, and state parks and historic sites are all part of this recreation resource base that reflects public response to the continuing growth in demand for outdoor recreation and tourism experiences in Missouri. At the same time, these lands are intertwined with an extensive array of privately-owned lands that contribute to the outdoor recreation and tourism experience in a variety of ways. Missouri's private forests provide the ecological continuity and landscape-level mosaic within which its public lands are situated. In addition to being an integral part of the scenic experiences of tourists and recreationists who visit this part of the state, they are increasingly seen as destinations for certain kinds of recreational outings. The leasing of private forestlands for hunting, and to a lesser extent hiking and camping, represents an increasingly popular role that such lands are playing in the area of outdoor recreation, in addition to their provision of scenic amenities as part of any recreational outing. Landowners derive income from making their lands available to meet a strong demand, while protecting the ecological integrity of the resource as well. Moreover, nothing precludes many of these activities being undertaken within a broader framework of sound forest management, which may include timber harvests as well.

The economic effects of the chip mills on the tourism industry in Missouri will be a direct consequence of the mills' effects on a variety of characteristics that make natural settings in the Ozarks desirable places to visit. In the aggregate these features comprise the landscape, which may be enjoyed by tourists for its scenic and other aesthetic qualities, as a source of knowledge, contemplation, and so on. Moreover, as will be considered in more detail in Section D, the chip mills will exert their primary environmental impact indirectly through the kinds of forest practices that are employed to supply the mills with chips. Since these will commonly involve clearcuts, it is through their effects that the primary impact of the chip mills on tourism and outdoor recreation will be felt. Thus, for example, if large and/or improperly situated or conducted clearcuts become widespread,

this could discourage many tourists from visiting the Ozarks, especially those with primarily nonconsumptive interests; and this in turn would weaken the livelihood of those involved in the tourism and hospitality industries in the region. As with many other problems affecting environmental sustainability, proper management could go a long way towards avoiding the problem to begin with.

On an overall basis, therefore, it is certainly possible that the location, size, and frequency of clearcutting practices in response to chip mill demands *could* impact tourism in the Missouri Ozarks; but at this point in time there is limited information even to construct scenarios depicting exactly what those affects might be.

Economic Incentives for Landowners and Firms

The capacity of Missouri's private forestlands to supply goods and services to the citizens of the state is a function of both private and public investments. Investment needs of well-managed forests differ from many other businesses. The investment must be held for long periods of time before financial returns are realized. Interest costs on invested capital must be paid for long periods of time. Forests have a low degree of liquidity; and the investments are subject to a low return rate relative to alternative capital investments. For these reasons, fiscal and tax incentives become important mechanisms for sustainable management on private forestlands.

Fiscal Incentives. *Fiscal incentives* are payments made to private forestland owners to help stimulate investments by reducing or offsetting large, initial capital costs and by improving rates of return. In this way, incentives encourage and reward investments in sustainability for long periods of time. An effective form of fiscal incentive is the cost share program, as exemplified by the federal Forestry Incentive and Stewardship Incentive Programs, both of which provide cost shares for implementing management practices such as reforestation and timber stand improvement.

The Forestry Division of the Missouri Department of Conservation serves as the primary technical consultant for all of the landowner cost share programs which have a tree component. These include the Conservation Reserve Program (CRP), the Forestry Incentive Program (FIP), the Stewardship Incentive Program (SIP), and MDC's Forest Cropland Program (FCL). During FY98, the agency made over 590 landowner contacts under CRP and provided planting plans for most. Through FIP, the Department was able to plant an additional 146 acres of trees, do timber stand improvement on 747 acres, and naturally regenerate 151 acres. Under the Stewardship Incentive Program, MDC accomplished the following management activities : 2250 acres of reforestation; 151 acres of natural regeneration; 2910 acres of timber stand improvement; 121 acres of wildlife enhancement; and the harvesting of more than 1 billion board feet of timber. Finally, the Department made 110 inspections of privately owned Forest Cropland during FY98 (Missouri Department of Conservation 1999b).

Considerations of these kinds of programs at the state level in Missouri has been complicated by the lack of a viable funding source to pay for them, especially in light of the distinctive constitutional amendment that affects availability of funds for government allocations in Missouri (i.e., the Hancock

Amendment). These programs are also viewed by some as less than entirely adequate due, ironically, to the long-term nature of the investments they are intended to stimulate. Some landowners are simply unenthusiastic about investing in such practices for which it will be such a long time before financial benefits are realized.. One innovative suggestion presented to the Governor's Advisory Committee involved creating a program (at the federal level) modeled on the federal Conservation Reserve Program (CRP) that would reward landowners for good management with an *annual* payment (e.g, $10 per acre) up to a certain limit for approved management practices. A state program along these lines might achieve positive results; again, however, the question of funding would have to be resolved. Any type of fiscal incentive at the state level is faced with a similar situation.

Tax Incentives. At a minimum, tax policy should promote savings and long-term investments in forest management, foster equity with non-forestry investments, be easy to administer and understand, and remain stable over long periods of time. Several federal taxes impact private forestland owners in distinctly different ways. As recently as 1994, for example, it was reported that among individual and family landowners, estate tax concerns were a driving force behind land sales (Northern Forest Lands Council 1994). However, the Taxpayer Relief Act of 1997 will make federal tax liability begin at an estate value of $1 million in 2006, or $1.3 million if the estate is part of a family-owned business (National Research Council 1998). In addition, exclusions from the estate are allowed for up to 40% of the value of forestland which is placed in a qualified conservation easement.

Other federal tax policies impact landowners in both positive and, at times, burdensome ways. The federal reforestation tax credit (not to exceed $1000 annually) has been widely used by nonindustrial forestland owners. On the other hand, the capital gains tax on forest income can be a major disincentive for long-term forestry investments. The Taxpayer relief Act did make some significant adjustments in the treatment of capital gains income from timber investments. For most owners, the capital gains tax dropped from 28% to 20% on timber sold after July 1997, and can drop to 18% for timber held five years beyond December 2000 (National Research Council 1998). One of the most burdensome federal tax policies affecting private forestland owners involves the tax treatment of management cost deductions. In order to claim a deduction for expenses such as site preparation, planting, vegetation control, and the like, individuals must record these expenses and then deduct them from income earned when the timber is sold. This treatment of capitalizing regeneration costs discourages many private forestland owners from managing and conserving their forests for long-term private and public benefits.

State and local tax policies provide another avenue for influencing the actions of private forestland owners with respect to sustainable forest management. Local governments rely on property taxes to raise revenues. In many states this has caused a significant tax burden on forestland owners, in large part because the agrarian property tax system has become hopelessly outdated. The situation in Missouri is, however, somewhat different than in most states. For most forestland owners in the state, property taxes are relatively low. Although this is undoubtedly appreciated by Missouri landowners when compared to their counterparts in other states, the low property tax rate also has the effect of precluding the use of the property tax as an incentive (e.g., via a tax credit) to practice

good forestry.

Another way of using the tax policy to provide incentives for sustainable forest management -- as opposed to a primary focus on raising money to fund government operations -- is through the use of a targeted severance tax. Such a tax may be levied on the value of the harvest (e.g., at 6%) to be paid by the forestland owner. Part or all of the tax may be refunded to that individual if he or she required the use of best management practices in the conduct of the harvest. The logic is one of creating a viable incentive to practice good forestry with the concurrent potential of eliminating the monetary impact of the tax. Receipts from the tax may be earmarked for encouraging sustainable forest management, such as, for example, educating landowners and providing them with further incentives to insist that best management practices be used when they have their timber harvested.

Business Incentives for Forest Products Firms. Publicly-funded incentives can also be a tool for encouraging development of natural resource-based and other industries and businesses in the state. State and local incentives have been ranked fairly high by business executives as significant factors in their decision where to locate and expand. About 4/5 of business executives consider these incentives important to their location decision. The Missouri Department of Economic Development (DED) uses incentives to encourage businesses to locate or expand in the state if it appears that significant social and economic benefits would be derived by Missouri citizens from such actions. At times companies, communities, or legislators may ask DED to use incentives for a business location or expansion project. The department will then analyze the proposal using an econometric model which, among other things, provides estimates of the social benefits and costs of the expansion or location incentive. DED and the community in which the business is locating then prepare a proposal addressing location criteria, and both participate in negotiations with the firm considering the action. Finally, the firm decides whether or not to accept the incentive offer.

Three basic kinds of incentives are used : a) financing incentives; b) tax credits; or c) job training incentives. These in turn may be associated with 4 types of incentive programs defined according to their primary purpose. These include : a) competitive programs, which are designed to help Missouri better compete with other states; b) redevelopment programs, which are designed to help develop properties in areas that would not normally be developed without an incentive (e.g., brownfields); c) entrepreneurial development programs to encourage new business start-ups; and d) community development programs to aid communities in developing infrastructure.

Incentive programs may also be described in terms of their overall flexibility of administration by DED. *Discretionary* programs are those which the Department has leeway to administer without many strings attached. *Formula-based* programs such as, for example, tax credit incentives, are created in law by the General Assembly, and thus conditions are often specified more rigidly with respect to their administration. In FY1998, the DED dispensed $61 million in incentives distributed over 252 projects. These led to a new annual payroll for more than 13 thousand jobs and almost $1.4 billion in investments by firms. The net benefit to the state in terms of new tax revenues was almost $250 million.

There are a number of incentives that would be available to a forest products manufacturer. Some focus on development in specific locations (e.g., enterprise zones), some on job training, and others on development in conjunction with public infrastructure or other projects in which a community is partly involved. The location of the chip mill owned by Canal Industries at Scott City was assisted through the Community Development Block Grant Industrial Infrastructure program in conjunction with an original project involving a grant to Scott County. Improvements were put in the SEMO Port Authority and the grant was approved for $312,000. Scott City committed $67,000 to the project. As a requirement for a private business to participate in this program, all the facilities had to be publicly owned. They are placed primarily in publicly owned areas and they require the participation of a company or companies to create private investment and jobs. The SEMO Port Authority, after working out an arrangement with Canal Wood to locate and supply the requisite number of jobs, was then able to approach DED with an application for assistance through CDBG Industrial Infrastructure program.[16] Canal Wood had an original investment of $10.45 million with a commitment to creating 20 new jobs. The company has met its investment and jobs commitments, and as of May 1999 the grant was in the process of being closed out.

In the above case the incentive benefitted a chip mill as part of a community development project in which four other firms received benefits as well. Incentives may also be provided to in-state businesses to expand or diversify their product lines. With respect to the forest products industry, for example, the Governor's Advisory Committee strongly endorses the idea of focusing incentives on those firms and industry segments that through expansion or diversification can provide substantial new jobs (in the aggregate) as well as enhance the value-adding process to primary timber products.

In addition to incentives originating exclusively in the Department of Economic Development, other state agencies such as the Departments of Conservation and Agriculture may also contribute to enhancing the production of forest products in Missouri and the marketing of those products via expanded export opportunities. This strengthens the key economic component of trade by keeping the value added part of the process, along with the associated jobs and income, *in* the state, while deriving income from final product sales elsewhere, thus facilitating income flows into Missouri.

Finally, rural economic development is not driven as much by resource dependent industries as it was in the past. These industries do still play an important role in a local community's economy. But qualities like communication, education, and the quality of life supported by rural amenities have become increasingly important in sustaining rural economies. Firms contributing to solidifying this significant component of rural social infrastructure should also be able to take advantage of the various opportunities to benefit from kinds of public incentives described above that are available to firms in the state.

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[16] There has been considerable misunderstanding as to the question of whether DED actively invited Canal Wood to locate in Scott City. From the above it is evident that this was not the case.

Innovative Institutional Arrangements

In addition to the range of economic impacts and opportunities that have come to the forefront with the arrival of the chip mills in Missouri, a variety of broader social implications and options have become evident as well. In searching for a solution to the problems and challenges associated with the 'chip mill issue,' one striking impact has been the emergence of one of the most wide ranging and comprehensive dialogues on Missouri forestry in years. At the same time, such debates present the opportunity to forge new linkages among the diverse participants in the state forestry community, and in the process perhaps establish more effective social arrangements to collectively engage in the challenges that will surely be experienced in the years ahead.

A broad group of government, industry and private organizations, as well as the 300 thousand nonindustrial private forestland owners in the state, will ultimately affect whether sustainable forest management in Missouri becomes a reality. Many institutional structures could enhance the ability of all groups and individuals to interact with one another in addressing the challenges faced by the state's forestry community. During the course of discussions by the Governor's Advisory Committee, several ideas were presented that outlined novel social arrangements that could be initiated to help make sustainable forestry a reality. These included the ideas of landowner management and/or marketing cooperatives, community-based forestry initiatives, and a statewide Forest resource Council. Each of these is considered briefly below.

Marketing Cooperatives. The basic idea underlying this type of organization is that of getting a group of landowners together in a given area to facilitate the marketing of wood products that would be uneconomical to sell on an individual basis. It was noted earlier that for some individual landowners, selective harvesting may be uneconomical due to lack of wood volume. Some landowners they may even opt for liquidating larger tracts in order to meet a certain desired level of return. In some areas, a marketing cooperative may help make selective harvesting practical and contribute to sustainably managed forests as well. Some landowners with smaller tracts have ventured into electronic marketing, in which they can solicit bidders from all over the country. While that particular innovation may have both positive and negative potentialities from a sustainable forestry standpoint, such a marketing tool collectively managed on behalf of a forestry cooperative could be a valuable asset.

Community-based Forestry. In southeastern Missouri, a committee was formed comprised of private landowners, University of Missouri Extension personnel, representatives from the Natural Resources Conservation Service, community development specialists, and foresters from the Missouri Department of Conservation for the purpose of looking at community forest initiative actions. The idea of the group centered around two basic objectives. First, the group was interested in developing methods to educate landowners about sustainable forest management in a manner similar to the Master Tree Farmer Program (see Section V); and secondly, the group wanted to assess how such practices might help revitalize communities by enhancing the sustainability and productivity of their forest lands. Although the group applied for a grant from the Ford Foundation, they were not successful in their efforts. Nonetheless, this noteworthy effort exemplifies the kind of approach that

will become increasingly important precisely because it recognizes and tries to address the linkages between education and community as essential ingredients of sustainable forest management. This it serves as an exemplary model for future efforts in this direction.

Statewide Forest Resource Council. One innovative idea presented to the Governor's Advisory Committee focused primarily on a long-term, potentially beneficial social impact which encompassed, but also extended beyond, the issue of chip mills in Missouri. Its focus was on the establishment of a lasting institutional structure to ensure that the entire forest resource base in Missouri would remain in the forefront of social consciousness. The idea was that of establishing a permanent *Forest Resource Council* for the state of Missouri. The Council would be comprised of various interested citizens, interest group and industry representatives, and university and state natural resource personnel, and would be responsive to natural resource and environmental issues, both current and future, that affect the state. One critical and often overlooked function of the Council would be to provide an ongoing forum for public discussion on emerging and potential natural resource issues in the state. With such a body in place, for example, topics such as the 'chip mill issue' would likely have been discussed and debated long before it became necessary to establish the Advisory

Table 10 . Minnesota Forest Resources Council : Structure and Responsibilities : 1998

Minnesota Institutions for Cooperative Engagement of Interests in the Development and Implementation of Major Forest-Resource Policies and Programs

Forest Resources Council

Structure: A 13-member governor-appointed council representing a broad range of organizations with interests in the use and management of the state's public and private forests.

Responsibilities: Major responsibility is to secure interest-group engagement in the development of forestry programs and concurrent commitment to their implementation. Specifically responsible for development and application of comprehensive timber harvesting and forest-management guidelines, and the establishment of mechanisms to facilitate coordination and planning across large forested landscapes with diverse ownership patterns. Also responsible for providing oversight to programs involving timber-harvester education, statewide information management, continuing education of natural-resources professionals, broad statewide public-education activities, coordination of priority forest-research efforts, and monitoring of resource conditions and guideline application. Advise governor and various levels of governments on major forest resource issues.

Measure of Success: The state's forests, communities, and economies sustained by effective application of programs developed and implemented by persons and organizations with interests in the sustainability of the state's forest resources.

Note : The MFRC has an extensive web site which may be found at : www.frc.state.mn.us/Info/bckgrnd/htm

Committee with a limited time frame to do its work. Another task of the Council could be the development of a comprehensive long- and short-range research plan to further examine this issue and others of importance to Missouri's forests and natural resources. The legislative establishment of such a Council would provide a solid basis for its functioning. State agencies such as the Missouri Departments of Conservation and Natural Resources could provide the seed monies to the Advisory Council for addressing the chip mill and other issues. The state of Minnesota offers a current example of where this idea has been successfully employed (Table 10).

D. ENVIRONMENTAL SUSTAINABILITY

The idea of sustainable forest management in Missouri embraces the notion that forestlands in the state are functioning ecosystems that must be sustained as such in order to ensure the sustainable social and economic well-being of Missourians. In this capacity Missouri's forests provide a wide range of ecological services. They protect soil, ensure quality water, store carbon, and provide habitat for wildlife. In addition to yielding a wide array of wood resources, they also provide a setting for many Missourians to pursue their recreational interests, whether they involve sporting ventures like camping, hunting and fishing, or more 'non-consumptive' activities such as hiking, birdwatching, or enjoying the aesthetic amenities of forested settings.

Earlier it was noted that the impacts of the chip mills in Missouri will be felt primarily in how their demands for wood are interpreted by and acted upon by landowners. This obviously depends on what motivates landowners with respect to their holdings, their knowledge of forest management and where to acquire needed expertise, and so on. It also depends on the actions taken by the mills themselves in broadcasting their demands. It has been demonstrated that sustainable forest management is possible on private lands, and that both even-and uneven-aged management regimes *can* be viable management tools *if* employed in situations warranting their use. It was also found that, at least in the case of a small study in Arkansas, most landowners did not practice sustainable forest management in selling their wood to the mills. Although both even- and uneven-aged management practices may be conducted poorly, given the far more extensive site disturbance associated with clearcutting, the environmental effects of improperly conducted 'even-aged' harvesting practices can be especially severe. Hence the concern that has been voiced by some regarding the potential for adverse environmental effects resulting from ill-advised or improperly conducted clearcuts on private lands in response to demands for chips emanating from the mills.

This section looks at some of the relevant factors that contribute to *environmental sustainability* and considers some of the possible environmental effects of harvesting conducted to supply the chip mills, along with certain additional measures designed to encourage sustainable forest management while at the same time fostering environmental sustainability. It is structured in terms of several environmental factors specified in the Governor's Executive Order that focus on possible environmental impacts from harvesting on private lands to supply chip mills in Missouri.

Soil Erosion and Fertility

Sustainability of the Ozark forest ecosystem is directly related to management of the system's soils and nutrients. Improper forest management practices can increase soil erosion and deplete soil nutrients. To understand the potential impact of chip mill operations on the long-term sustainability of the Ozark forest ecosystem, it is important to consider Ozark forest soils in context to their formation, past use and erosion, and present fertility.

Forest soils of the Missouri Ozarks. Most Missouri Ozark forest soils formed from multiple parent materials, including residuum (weathered rocks of local origin), loess and hillslope sediments. Loess is wind-blown silt-sized material of glacial origin. It is very erodible and was deposited as a veneer of two to three feet in thickness over much of the Ozarks after the last glaciation (about 12,000 y BP). Prior to European influences in the landscape, some of the loess was being eroded and differentially moved. Much of this loess was incorporated into hillslope sediments by geomorphic processes and events. Hillslope sediments are the materials that move slowly downslope as a consequence of the combined effects of water movement and gravity. Most Ozark forest soils have veneer of hillslope sediments.

Most Ozark forest soils are extremely old, and have been subject to intense leaching under warm temperatures for many hundreds of thousands of years. Leaching removes nutrients from soils. As a consequence of this weathering, many Ozark forest soils are classified as "Ultisols," the diagnostic feature of which is a high subsoil clay concentration with low nutrient status.

Soil Erosion. Most of the forested Missouri Ozark terrain has undergone accelerated soil erosion within the past 150 years. Much of this is attributable to extensive timber harvests and land clearing during the late 19th century and early 20th century. Erosion has been most severe where timber harvest was followed by row-cropping on steep slopes, and over-grazing of forest regrowth by cattle and hogs. Accelerated erosion has removed much of the remaining soil that was most capable of supplying nutrients and water.

Evidence of the past erosion is obvious to trained field soil scientists as a lag-gravel deposit, or stone line, at or near the surface of the current soil. The stone lines developed as a consequence of erosional removal of fine-textured soil particles with a resulting concentration of the rocks at the new soil surface. Some recent stone lines are now under younger deposits of hillslope sediments that have eroded subsequently from higher landscape positions. This phenomenon has been described by Hammer (1997) and is well documented on Missouri Ozark Forest Ecosystem Project (MOFEP) lands. A soil science graduate student from another state recently referred to soils on the MOFEP site as "the soils that crunch" because of the abundance of surface rocks. Well established stone lines help to inhibit further soil erosion. The rock cover inhibits soil particle detachment, which is the necessary first step in soil erosion. An abundant forest soils literature documents that soil erosion as a consequence of timber harvest is usually limited to the time required for vegetation to re-establish. If soils are not severely compacted or rutted during timber harvest, re-vegetation can be rapid and extensive.

One poorly documented kind of soil loss in the Ozarks is slumping, mud flows, debris slides and other mass movement events. Evidence is extensive that these kinds of events were common in the distant and recent past. Timber harvesting can greatly increase the likelihood of these kinds of erosional events if steep slopes are completely harvested and the harvest is followed by prolonged or dramatic wetness. The mass movements are exacerbated by the loss of vegetation to buffer the impact of falling rain and the death of plant roots that hold the soils in place.

Of greater importance from the perspective of forest "sustainability" is the loss of organic matter from the forest floor (organic debris over the mineral soil) and the soil A horizon following timber harvest. This is the portion of the soil profile within which minerals are rapidly released by microbes and made available for vegetation. The process is called "mineralization." The pool of minerals in the forest floor and A-horizons is relatively small, but is disproportionally important because of the biological speed and persistence of the process.

Much material eroded from Ozark forest soils in the past did not leave the landscape, but was deposited in concavities in lower slope positions and on floodplains. As a consequence, the relative fertility of Ozark forest soils is quiet heterogeneous and is very site-specific. Wise forest management will inventory the attributes and distributions of the soil resource, place the soils in the context of their landscapes, and will design timber practices with soil-landform attributes as one framework of the management strategy.

Soil Fertility. Forests are regarded as a "renewable resource" but the extent to which forest composition and growth can be maintained is a function of the abilities of individual forests sites to provide nutrients to forest species. Discussions of the impacts of chip mill operations in Missouri generally have been in the context of water quality, soil erosion, aesthetics, and forest genetics. Little dialogue has addressed the impact of forest harvest on soil fertility. Soil fertility is classically defined as the ability of the soil to provide the necessary nutrients in the proper proportions and the proper quantities.

Most soils in Missouri Ozark forests are very weathered and previous episodes of soil erosion have removed most of the soil that was capable of supplying nutrients. As a consequence, nutrients in most Ozark forest soils are in very low abundance. Three very important macro-nutrients that are generally in very low abundance in Missouri Ozark forest are phosphorus (P), calcium (Ca), and nitrogen (N).

Phosphorus in Ozark forest soils was recently studied by King (1997). Her results showed that plant-available P is extremely low. The primary sources of soil P is primary minerals (principally apatite). Apatite is not common in the sedimentary rocks common to the Ozarks. Phosphorus complexes easily with oxides of iron (Fe) and aluminum (Al) below pH 5.5. Ozark soils are acidic and have Fe and Al in large concentrations, so what little P is is present in these soils is occluded (bound) to the Fe and Al. Most of the biologically available P in Ozark soils is in the organic matter and biota. Improper timber harvesting will remove the P in biomass and will expose the soil organic matter to oxidation and erosion.

Calcium is limiting in Ozark forest soils because the limestone weathers by dissolution. The Ca is leached, and the limestone impurities, principally iron and aluminum remain behind as soil material. Unpublished research by G. Henderson (University of Missouri) showed positive root responses of oak (*Quercus spp.*) to Ca additions in soil cores. Most of the plant-available Ca is in the forest floor and soil organic matter. Long-term calcium supplies in Ozark forests are of particular concern because oak requires large quantities of calcium in its structural tissues. Additionally, much of the

weatherable calcium-enriched bedrock is deeply buried. The abilities of tree roots to penetrate to depths that will allow calcium uptake is problematic if harvest rotations are shortened.

Nitrogen in forest soils comes from the atmosphere. It is "fixed" or brought into the forest ecosystem by soil organisms and certain kinds of plants and is stored in the soil and soil organic matter. Nitrogen is generally limiting in most forest ecosystems as well as in Ozark forests. Improper timber harvesting removes too much N stored in biomass and will expose the soil organic matter to oxidation and the soil to erosion.

Forest management practices in relation to soil erosion and fertility. Timber harvesting can adversely affect soils and long-term nutrient supply if done improperly. Nearly 90 percent of the erosion from timber harvesting is traced to the logging road system, which can exceed 17 tons per acre per year (USEPA 1973). Tolerable soil loss in the Ozarks may be one to three tons per acre per year (USDA-NRCS). The extent of soil loss depends on precipitation amounts, the type of road surface, the road grade, length of road segment between grade breaks designed to drain the road surface, and the amount of cut and fill done during road construction.

The forest regeneration method of clearcutting has received considerable attention by the public. However, clearcutting in the Ozarks can be a proper regeneration method if practiced carefully. The term "clearcutting" has different meanings for the professional forester than for other audiences. The professional forester thinks in terms of stand regeneration when planning a timber removal of any kind. This approach includes an awareness of the site-specific attributes of the forest and its soil-landscape setting. As with any other improperly conducted harvesting practice, clearcutting can increase the risk of soil erosion. However, if done properly, erosion rates are similar to undisturbed forests (Johnson 1997). Erosion losses of 0.05 to 0.10 tons per acre per year were recorded in West Virginia for both undisturbed and clearcut forests (Patric 1977). Even where erosion from harvesting exceeded pre-harvest levels, soil losses usually reach pre-harvest levels after 2 to 5 years (Patric 1976).

As discussed above the term "clearcutting" has a different meaning to professional foresters than to others. It is important to distinguish between "clearcutting" as a forest management harvest practice and "clearcutting" as the indiscriminate tree removal for the value of the timber without consideration of forest regeneration or post-logging ramifications either on or off the site. Good forest management is not indiscriminate and requires planning for forest regeneration, and protecting soil resources from erosion and nutrient depletion.

Harvesting causes some nutrient losses from soil erosion. Nutrients are also lost in other ways. Timber harvesting exposes leaf litter and soil organic matter and increases their decomposition and mineralization. Mineralization releases nutrients, allowing them to be leached from the site. Harvest practices that increase the total area of exposed soil surface increase the amount of litter and organic matter decomposed and subsequently increase nutrient losses. Nutrient losses by organic matter mineralization and leaching can be substantial immediately after timber harvesting but return to pre-

harvest levels within three to five years as sites become re-vegetated (Iseman et al. 1999; Kimmins 1997; Romanowicz et al. 1996).

Nutrients are also removed from the site in the harvested timber biomass. Although the amount of nutrients removed through timber harvesting in the Missouri Ozarks is unknown, most investigations conducted elsewhere show that sawlog harvests over medium to long rotations (80-120 years) pose little or no threat to nutrient availability (Johnson et al. 1998; Kimmins 1997). However, increasing the total biomass removed from the site during a harvest, and shortening the rotation age may deplete soil nutrients faster than they can be naturally replenished.

Chip mill operations do have the potential to affect forest soils and nutrient management in ways dramatically different than any timber harvesting or land-clearing activities previously or currently practiced in the Ozarks because they provide markets for smaller, younger, or lower-quality trees. Some potential effects of chip mill operations include: 1) shorter harvesting rotations, and therefore, shorter intervals between nutrient removals in timber biomass; 2) greater nutrient removals because more trees are removed from the site per harvest; 3) more extensive tree (and nutrient) removals over larger tracts of land and more total area than other timber harvests in the past several decades. All of these accelerate nutrient depletion and can accelerate erosion where cutting occurs over large areas on steep slopes. Erosion and nutrient losses will be exacerbated if the forest is not allowed to regenerate and is cleared for development or pasture.

In summary, Ozark forest soils have a limited capacity to supply nutrients and are vulnerable to nutrient depletion. Care must be taken so that forest management practices foster the long-term productivity of Ozark forest soils. Ozark forest soils have been subjected to erosion and weathering for thousands of years. Consequently, major plant nutrients, P, Ca, and N are in low quantities. Timber harvesting, especially if extensive or improperly applied, can increase soil erosion and will exacerbate the shortages of these nutrients, and will limit species distributions and tree growth in subsequent rotations. Long range forest management practices should consider soil erosion susceptibility and soil fertility and their variation in the landscape if predictions of future forest productivity are to be based in fact rather than speculation.

Water Quality, Sedimentation and Watershed Protection

The concept of sustainability in forestry practices generally includes the desire to restrict offsite, downstream detrimental effects to some level acceptable to society while maintaining long-term productivity of forest products.[17] This understanding of sustainability motivates the need to understand how timber harvest affects streams, how far downstream the effects extend, and how long effects persist.

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[17] The primary source of information for this discussion of water quality , sedimentation, and watershed protection is Jacobson (1999).

Timber harvesting practices inevitably cause some measure of downstream effects. These effects can be categorized in terms of alterations of:

a) hydrologic characteristics : water yield and storm flows
b) water quality characteristics : dissolved load (biogeochemical) and suspended sediment
c) sediment budgets.

The Ozark region lacks any long-term, instrumental record of hydrologic, water quality, and sediment responses at scales relevant to timber harvests. Hence, current understanding of possible timber harvest effects must be developed from research conducted elsewhere. Timber harvest has been one of the many land uses in the Ozarks over the last 160 years. The combination of past and present land uses also potentially lowers thresholds of stream disturbance and therefore may increase the disturbance effects of present-day timber harvests.

Changes in evapotranspiration resulting from timber harvesting will generally result in an altered water balance and distribution of water between baseflow and runoff. Changes in biomass uptake and soil conditions will interrupt nutrient cycles. Any disruption of the ground surface by skid trails, roads, or traffic will disrupt hydrologic pathways and provide opportunities for soil erosion at greater than natural rates. The combination of these changes can alter water yield, peak flows, water quality, and sediment yield.

Among the above factors, sedimentation induced directly or indirectly from timber harvesting is perhaps the most pressing concern in terms of potential ecological sustainability. Changes in sediment budgets can result in onsite degradation from soil erosion or offsite effects measurable in terms of aquatic habitat degradation, accelerated channel erosion, or excessive sedimentation. Whether timber management activities contribute to any of the above depends on many factors, including geologic and climatic context, intensity of harvest, design of access roads and skid trails, accumulated history of landscape disturbance, timing of harvest, and spatial arrangement of harvest patches in the landscape.

From a watershed perspective, the spatial pattern of timber harvest within a drainage basin -- how much is harvested at what rate, in which drainage basin, in what pattern, etc. -- can be an important determinant of the magnitude and downstream cumulative effects of harvesting (Grant and Swanson 1991). Although sediment delivery from an individual harvest may be modest, the delivery from other harvest tracts within the basin and at different times may be additive. The cumulative response of stream habitats to timber harvests scattered through time and space may also be governed by thresholds of irreversible change. On an overall basis, present-day timber harvesting in the Ozarks occurs within a system that has undergone historical destabilization and which probably has surpassed important thresholds of change. Additional marginal stress from hydrologic or sediment yield changes associated with timber harvesting may be capable of maintaining instability and preventing recovery.

In summary, a number of conclusions may be reached regarding the potential impacts of timber harvesting -- whether motivated by a response to chip mill demands or otherwise -- on water quality,

Table 11. Overview of state of knowledge regarding downstream effects of timber harvesting in the Ozarks (Source: Jacobson 1999)

A) *What is known* (with some confidence)

- Timber harvest generally increases water yield and enhances base flows
- Timber harvest has the potential to increase storm flows
- Timber harvest effects on dissolved phase water quality appear to be minimal
- Timber harvest has significant potential to increase sediment yields through direct soil disturbance and storm flow erosion of stream beds and banks
- In general, the most important factor in increasing storm flow and sediment yield is the design and density of trails and haul roads
- The geological history of the Ozarks is such that deposited gravel-rich sediments have been deposited near streams where disturbance can deliver sediment rapidly
- Streams in the Ozarks have been much more sensitive to riparian land-use changes than upland land use changes
- Cyclic timber harvest probably has less downstream effects than alternative agricultural land uses

B) *What is not known*

- The importance of spatial scale and pattern to downstream cumulative effects
- The degree to which low-order Ozark streams have recovered from historical disturbance
- The importance of transient fine sediment impacts and thresholds of stream biota
- Quantitative understanding of sources and rates of sediment yield associated with timber harvesting and forest roads

sedimentation, and watershed protection (Table 11). At the same time, there is much that is not known about how streams in Missouri and elsewhere in the Midwest will respond to hydrologic, water quality, and sediment stresses from timber harvesting. The concept of sustainable forestry seems to encompass the idea that timber harvesting will be planned to impose minimal and acceptable levels of environmental degradation downstream. Improved understanding of downstream effects of timber harvesting (and other land uses) in the Ozarks will require investment in long-term, detailed, quantitative assessment of responses at the drainage basin and watershed scale.

Biodiversity and Species Conservation

Missouri is home to a diverse array of plants, animals and natural communities. More than 5 thousand species of plants and at least 20 thousand animals occur in almost 200 recognized communities across the state (Biodiversity Task Force 1992). The great geologic age and physiographic diversity of the Ozarks has made it by far the most biologically diverse region in the state, and one of the most significant centers of biodiversity in North America. Many unusual communities, both terrestrial and aquatic, are endemic to the Ozarks, and many others have their only

Missouri location here. Ozarks fens are the only fens known from unglaciated North America, and they provide habitat for many plant species whose normal ranges occur far to the north. Ozark caves and springs are home to many rare or unique species. The most extensive glades in the Midwest are found in the Ozarks; many plant species are endemic to Ozarkian glades and several desert-adapted animals occur there. The largest savanna and forested landscapes in Missouri are found in the Ozarks. In short, the Missouri Ozarks is truly a diverse and outstanding natural region in both the state and on the North American continent.

Biodiversity may be defined as the variety and variability among living organisms and the ecological complexes in which they occur (U.S. Office of Technology & Assessment 1987). The term encompasses not only all species everywhere, but the variations in the composition, structure, and functional process of the ecosystems in which they live. Biodiversity is often described in terms of three levels or dimensions.[18] The first pertains to the number of species that exist in an area. This measure is often referred to as *species richness*, and it may be subdivided according to how localized the particular place of interest is (e.g., the number of species in a single locale; the difference in species composition between two neighboring habitats; and the combination of these two. The second measure of biodiversity is *habitat diversity*, which measures differences in species composition in terms of the different habitats in a landscape (e.g., a slope and a ridge). Finally, *genetic diversity* is a measure of the differences in genetic composition of individuals in populations or populations in a species over a broad geographical area. It is evident from the above that the multidimensional nature of biodiversity reflects a scale of biological and ecological organization ranging from the gene through the species (or population of species members) to communities or ecosystems and, ultimately, local and regional landscapes. Each level of organization demands a different way, or scale, of thinking about nature (Scott et al. 1999).

With respect to species richness and species of conservation concern, it should be noted that rareness or rarity *is* a natural phenomenon. The more rare or uncommon a given species is, the higher probability of its becoming extinct. The obvious management guideline in such a case is to avoid allowing species to get into situations where they become rare when otherwise they are not.

Succession is the process that occurs in natural systems when they have gone through a disturbance. One of a sequence of patterns that occurs in communities recovering from a disturbance involves biomass accumulation. When the focus is on biomass as timber, it is generally desirable to harvest a stand when its biomass reaches a point where it does not increase, e.g., a stand age of 60 to 80 years. However, when considering species that inhabit an area, species richness continues to increase beyond the point where the biomass accumulation has leveled off, e.g., up to 150 years for Eastern forests and 300 years for Western forests. The management implication here is that in managing forests for biodiversity, it is desirable to try and increase the amount of mature and old-growth forests, for species richness continues to increase through those ages.

There are over 950 species on the Missouri Department of Conservation's 'list of conservation

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[18] The primary source of information on the key dimensions of biodiversity is Journet (1999).

concern' in Missouri. Table 12 depicts the kinds of forested habitats in Missouri and the number of species of conservation concern associated with each. The number of species of conservation concern is much greater in mature forests than younger ones, although they occur in both kinds of habitats.

Table 12. Forested habitats of Missouri and the number of species listed as *species of conservation concern*

Habitat type	Species of Conservation Concern
Forest-field edge	14
Immature hardwoods (poles/saplings 3-9" dbh)	7
Oak-hickory regeneration (0-3 yr.)	6
Oak-hickory regeneration (3-10 yr.)	6
Shortleaf pine reproduction (0-3" dbh)	5
Mature oak-hickory (9+" dbh, open understory)	14
Mature oak-hickory (9+" dbh, dense understory)	20
Oak-hickory old growth	16
Mature shortleaf pine	14
Shortleaf pine old growth	12
Swamp	22
Wooded riparian and bottomland forest	27

The Missouri Department of Conservation searched its Heritage Data base for species and natural communities in an 18-county area in Southeast Missouri encompassing the combined source areas for the Mill Spring and Scott City facilities (MDC 1999a). A total of 269 records on natural communities on private lands were found (38% of all community records), but only 36 are privately owned forest communities that could likely be logged (the remaining are wetland and open land communities). With respect to individual species, there were occurrence records for 149 state rare and 180 state endangered species. A total of 199 plant species in the 18-county area are classified as state rare or endangered, with 31 of the plant records pertaining to species cited only on private lands. Most such plants are found in habitats that are not likely to be logged. However, some habitats (e.g., fens, swamps, etc.) can be degraded through erosion and water quality changes triggered by adjacent timber harvests. Finally, there are 14 federally threatened or endangered species in the18-county area recorded at 248 locations. Twenty-eight wildlife, fish, and insect species within the area are recorded only from private lands, with 23 of these classified as state rare or state endangered (MDC 1999a).

The preceding sketch suggests that conservation of biodiversity is a multifaceted challenge that

extends across a hierarchy of ecological scales from gene to landscape. Conserving species richness (and their genetic diversity) cannot succeed without conserving the habitats and landscapes -- i.e., the ecosystems -- in which the former are embedded. When attention is focused on ecosystems as habitats for maintaining biodiversity, and in particular on the forested landscapes of Missouri as distinctive habitats for a wide range of species, the challenge is further complicated by the widespread phenomenon of forest fragmentation.

Forest Fragmentation

Habitat fragmentation is not a unitary process : it consists of a number of different mechanisms, of which the most important are the loss of total area from the habitat and its fragmentation into a system of smaller patches. A primary example involving Missouri forests is the current situation with neotropical migratory songbirds, i.e., birds that migrate to the tropical forests of Central and South America for the winter. Ornithologists throughout the United States have become concerned about the overall decline in abundance of a large number of once common woodland bird species. In some areas where bird populations have been monitored over the last 40 years, the density of some songbird species has decreased by as much as 50% (Dobson 1998). A number of mechanisms have been suggested to explain these declines. Biologists have noted that a number of these declining species can still be found in large, contiguous tracts of forestlands in the United States, but that the bird populations are most impoverished in smaller, isolated tracts.

At the same time, due to changing agricultural practices, there has been a large increase in the range and population size of the brown-headed cowbird. Cowbirds parasitize a range of songbird species by laying their eggs in the nests of those species. The true offspring may starve while the larger cowbird offspring monopolize the food brought by the parents. Since many neotropical migrant species only produce one brood of young in any breeding season, they are especially susceptible to brood parasitism by cowbirds.

The success of the cowbirds has been considerably aided by the fragmentation of forests into smaller patches. Because the cowbirds prefer to feed in open agricultural areas, they tend to penetrate only several hundred yards into the forest when searching for host nests to parasitize. Nests at the center of forests that are larger than a kilometer in diameter are relatively safe from parasitism. In a highly fragmented landscape, however, most woodlots will be small and without any substantial *core area*. A wood thrush population that would be mostly unmolested by cowbirds in a heavily forested area will have more than70% of its nests parasitized once the percentage of land covered by forests falls below 40%

Moreover, birds nesting in smaller woodlots are not only more susceptible to cowbirds, but also to nest predation by racoons, blue jays and crows. The higher rate of predation and parasitism around the perimeter of forests is termed an *edge effect*. Forests edges are brighter and warmer, as well as drier and windier, than the forest interior; and they shelter more shrubs, vines and weeds. It has been

found that edge-related increases in predation (in addition to parasitism) may extend from 300 to 600 meters into the forest.

Neotropical migratory birds are the focus of one of the largest international conservation efforts ever for non-game, not-yet-endangered wildlife (Robinson 1995). The forests of the Missouri Ozarks support 70 species of neotropical migratory birds, many in large numbers. Equally important, the Ozarks may serve as a bird source for a vast area spanning the Central Hardwood Region and covering forests of several neighboring states (Thompson et al. 1995). This directly reflects the high quality habitat provided by Missouri Ozark forests, and the birds' reproductive success allows them to populate other areas of the Midwest that no longer possess sufficient breeding areas.

The dynamics of core and edge areas, and the decline of the former as a consequence of forest fragmentation, also point to the increasingly important role of public lands in the maintenance of larger, contiguous blocks of forestlands that may serve as core areas for the variety of area-sensitive wildlife species in Missouri. The relatively large area administered by the Mark Twain National Forest (10 % of the state's total timberland area) does offer some opportunity for preserving core habitat areas. This task is, however, somewhat more difficult for the Missouri State Park system.

Many of the natural values and functions of state park forests are linked to providing large areas of native natural forested ecosystems that are not manipulated for consumptive use. Usually, however, Missouri's state park lands are much smaller parts of a much larger forested landscape. In this light, privately-owned forestlands surrounding state parks may perform a valuable function as buffers protecting vulnerable core areas within park boundaries. Continuing fragmentation of forestlands within these buffer zones is obviously not conducive to such an end. A 1992 study by the Missouri Department of Natural Resources voiced concern over the ecological impacts of land-use changes occurring around state park boundaries. The study noted 60 instances of ecosystem degradation, with half of the sources traced to land use changes. Concerns centered on ecosystem fragmentation and isolation with resultant unnatural concentrations of wildlife, interruptions in travel corridors to nearby habitats, and populations diminished and/or genetically isolated (Missouri DNR 1992). Together these reflected an overall concern that certain parks would lose the buffer and protection of being part of larger natural landscapes, with concurrent potential for species loss. Ultimately the parks' ability to function as preserves of native species living in their natural habitats would diminish.

The problem of forest fragmentation, particularly for a state such as Missouri in which more than 85% of the forest resource is under nonindustrial private ownership, has been occurring for some time, well before the arrival of the chip mills. Again the potential environmental concerns which link the mills to forest fragmentation and effects on species such as neotropical bird populations derive from one potential scenario which may, but not necessarily will, result from the effects of mill demands on Missouri private forest management. In that scenario, if the increased demand for timber resources resulting from chip mill operations contributes significantly to increases in the size and total acreage of clearcuts, or even if it simply leads to decreased rotation lengths for lands which include substantial blocks of timber; by accelerating fragmentation even further, this could have an impact on bird communities that would be regional, and actually international in scope. Suitable habitat for

birds which require more mature timber, and especially those species which are area sensitive and require larger expanses or core areas of timber, could be expected to decline.

Given the pattern of land ownership in Missouri, the long-term sustainability of biodiversity of the state's flora and fauna is indeed a difficult challenge. According to the Biodiversity Task Force (1992), this will require identifying and protecting the state's ecosystems, as well as maintenance of ecological structure, function, and composition in the region. Core areas need to be maintained that contain a mosaic of communities, especially those that are currently threatened. Such areas should:

- Maintain mosaics of ecosystems and successional stages, and a large number of species
- Enable species to respond to long-term environmental changes and stresses
- Minimize edge effects
- Meet the needs of wide-ranging animals such as black bear
- To the extent possible, maintain habitat corridors to permit plant and animal dispersal (e.g., riparian corridors linking old growth forest ecosystems, etc.)

With respect to private lands, education and incentives encouraging landowners to understand and recognize the ecological roles of their lands in a broader landscape should be an important ingredient in any integrated education and technical assistance efforts.

Recreation and Aesthetic Amenities

The 1997 report "Outdoor Recreation in the United States" stated that 94.5% of Americans sixteen years of age or older participate in some type of outdoor recreation activity (U.S. Forest Service 1997). One of the most popular activities is sightseeing, with over 100 million participants nationwide. The report also noted that it was unlikely that the popularity of sightseeing as a base activity of tourism would decline while numbers of retirees continue to increase. It was also stated that 98% of respondents surveyed in this region of the country felt that the quality of scenery at a recreation area was a moderate to extremely important attribute in making that area an ideal recreation setting. A 1995 survey of visitors to state parks and historic sites found similar results (O'Connor & Partners et al. 1995). Although traditionally a difficult aspect of resource 'utilization' in terms of valuation, the aesthetic experience of forest-based amenities is certainly a significant 'output' of forest lands, both nationally and in Missouri.

In part this reflects the trend noted earlier that nonconsumptive recreational activities such as birdwatching, wildlife photography, etc, are increasing at an average annual rate which exceeds all other wildlife-oriented recreation (Knight & Gutzwiller 1995). At present, on an annual basis, approximately 62 million people undertake outdoor recreation activities to view wildlife, in contrast to about 19 million people who participate in hunting activities (U.S. Forest Service 1997).

Enjoying the aesthetic amenities of forested settings as part of a recreational experience in effect engages all of the environmental characteristics of the forest considered thus far -- trees, topography,

wildlife, waters, soils and geology, and so on. It is basically experiencing the ecosystem in its full range of characteristics. Any impairment of these environmental components will, therefore, reduce the quality of the amenities experienced. Thus it is not surprising that the linkage of chip mills to nonconsumptive experiences of private forest lands will be mediated by the practices adopted by private landowners in response to demand for chips by the mills. Thus, for example, depending on its frequency, size and other variables, the visual effect of clearcutting in viewsheds around and leading to recreation sites in the Ozarks could have a significant impact on the total recreational experience of visitors.

Such effects are, unfortunately, notoriously difficult to quantify. Thus, for example, the authors of the Arkansas study of export chip mills discussed earlier did not feel confident in declaring some sort of definitive effect of the harvesting stimulated by the mills on tourism. They did, however, suggest that the *location* of harvests, perhaps as much as their total area, was a critical factor in terms of their ultimate impacts on the nonconsumptive aspects of the tourism experience (Guldin 1999).

Standards and Permits to Ensure Environmental Sustainability

When considering the linkage of the chip mills to environmental sustainability in all its various components -- i.e., soil fertility and prevention of erosion, water quality and quantity, biodiversity and ecological integrity, recreational activities, or the appreciation of forested landscapes for their scenic beauty -- a common connection emerges. Bad harvesting practices degrade all of the above simultaneously; effective forest management can help sustain all of them simultaneously. The chip mills are linked to these components of environmental sustainability through the kinds of forest practices undertaken by landowners in responding to the markets for chips created by the mills.

History plays an important factor in this overall process as well. Missouri's nonindustrial private forestland owners have on the whole been guilty of poor forest management for years. Thus even had no chip mills arrived in the state in the late 1990's, there would still be concerns about the impacts of forest practices on private lands upon the various components of environmental sustainability considered earlier. The concern with the chip mills, therefore, is not that they will suddenly transform a perfect situation -- i.e., a situation where forest management across the state is being conducted so well overall that environmental sustainability is not a concern -- into an environmental catastrophe; but rather that the increased demand for wood generated by the chip mills will exacerbate a longstanding pattern of poor forest management and in the process contribute an additional threat to environmental sustainability.

Different perspectives have emerged as to whether this is likely to happen. Some see an opportunity for the utilization of an extensive amount of cull material in Missouri forests and a concurrent opportunity for improving growing stock through better forest management, thereby contributing to environmental sustainability. Others look at the past history of poor forest management and see little that the increased demand for chips will likely do but give landowners another excuse to continue managing their lands poorly, in the process doing nothing to enhance environmental sustainability and

very likely weakening it. Thus the essence of the issue involving environmental sustainability lies in the avoidance of a possible *scenario* occurring -- it might be called the "Bad Scenario" -- not necessarily as an exclusive *result* of the chip mills, but to which the chip mills would contribute, and possibly exacerbate (Table 13).

Table 13. A scenario involving the chip mills with negative implications for environmental sustainability ("Bad Scenario").

Demand for wood including chips	-->	**Increased unsound harvesting practices**	-->	**Decrease in environmental sustainability**

a) Increased demand for wood by chip mills is responded to by landowners.
b) In meeting this demand, landowners continue to practice poor management as they have in the past.
c) The management practice employed is clearcutting, since this is by far the easiest way to meet chip mill demand.
d) Increased clearcutting to meet demand may be manifest in either :
   - Larger clearcuts (but not necessarily so)
   - Shorter 'rotation' lengths --> As soon as total volume on site becomes great enough (with no attention paid to stand structure, composition, etc.), then it is cut to generate income by supplying chips. Increased cutting at, for example, stand age of 30 years implies less timber reaching sawlog size.
e) The combined effects of the above clearcutting activities result in any or all of the following :
   - Increased erosion
   - Decreased soil fertility
   - Impaired water quality -> Both for humans (drinking) and as habitat for biota
   - Negative impacts on biodiversity via, among other things, accelerated habitat fragmentation
   - Negative impacts on aesthetic values as a primary motivating factor in consumers served by the outdoor recreation and tourism industries

* The combined effects of the above --> Decrease in environmental sustainability

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In terms of public policy, the critical questions that need to be addressed would therefore seem to be: a) how to *encourage a good scenario* and *avoid the bad scenario*; and b) how to deal with cases (particularly severe ones) of the "bad scenario" -- i.e, the question of 'bad actors.'

In Missouri, two public agencies are principally involved in efforts to ensure environmental sustainability of the state's forest lands -- the Missouri Department of Conservation (MDC) and the

Missouri Department of Natural Resources (MDNR). Part of MDC's responsibilities include encouraging sustainable forest management on the state's privately-owned forest lands. A major responsibility of MDNR lies with ensuring water quality and quantity (i.e., streamflow) under the auspices of the federal Clean Water Act. Both agencies attempt to encourage landowners to practice forestry in an environmentally sustainable way through the issuance of standards and guidelines which together comprise a set of "best management practices" for timber harvesting. In addition to educational programs directed towards private landowners (see Section E), MDC has issued a document outlining watershed protection practices, which is essentially a set of voluntary management guidelines focused on stream protection during timber harvesting activities. MDNR approaches its task in the context of its role in preventing "nonpoint source pollution" (NPSP) of Missouri streams, rivers and other bodies of water. One potential source of such pollution is improperly conducted silvicultural practices. The roles of these two agencies are considered further below.

Best Management Practices. The Federal Water Pollution Control Act (FWPCA) was enacted in 1972. The goal of this act was to control water pollution which was categorized as point source or nonpoint source. Point source pollution comes from single identifiable source, such as a drain pipe. Nonpoint source pollution (NPSP) is harder to trace, and includes runoff from agriculture, forestry, urban development, or mining. Section 208 of the FWPCA mandated that states develop and implement a water quality plan that included addressing nonpoint source pollution. The plan was subject to Environmental Protection Agency (EPA) approval.

In 1977, the 1972 FWPCA was amended to exempt normal silvicultural and agricultural activities from the permitting requirements under Section 404(f). Also, construction and maintenance of farm and forest roads were exempt when accomplished in accordance with approved *best management practices* (BMPs). These are a practice, or a combination of practices, that are determined by a state after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practical means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals (Tennessee Valley Authority et al. 1993). BMPs address preharvest planning, truck haul roads, log landings, skid trails, streamside management zones, site preparation, woodland grazing, and revegetation.

In 1987, the FWPCA was amended once again. Section 319 said that nonpoint source pollution was still a problem and required states to develop a specific water quality management plan that was to be implemented and evaluated for compliance by 1992. The states responded with a variety of strategic plans. The state of Missouri issued a draft revised version of its "Nonpoint Source Management Plan" in June of 1999. The plan contains a comprehensive set of objectives, implementation strategies, and evaluation measures designed to accomplish three broad goals : a) water quality assessment, monitoring and prioritization; b) water quality improvement and protection; and c) state nonpoint source program management.

Two aspects of MDNR's role complicate its efforts to carry out its mission. The first is its primary focus on water in accordance with its role as the state agency through which the federal Clean Water

Act is implemented. Although ensuring water quality certainly involves many other on-site resources, particularly soils and topographical considerations, it is not quite the same thing as focusing on forests *per se* as the primary resource of concern. A second factor complicating MDNR's task is that it exercises its enforcement role in ensuring water quality primarily on a complaint-only basis -- i.e., after the damage has been done, so to speak. Then the agency must also frequently deal with nonpoint pollution problems in which the source may be some distance removed from where the problem is actually reported (e.g., a sub-watershed within a larger watershed, etc.). At present the agency has limited means of addressing these kinds of problems from a more preventive or 'before-the-fact' posture.

The Nonpoint Source Management Plan does contain a section (Appendix E) concerned with silvicultural practices and their relationship to water quality. It is condensed from an earlier report on Missouri silvicultural and watershed protection practices produced by the Silviculture and Watershed Protection Practices Committee in 1987, which was convened and chaired by MDC (Missouri Department of Conservation 1987). The appendix considers effects of silvicultural practices on water quality variables such as temperature, dissolved oxygen, nutrient losses, turbidity, suspended solids, and sediment; and it briefly discusses methods for decreasing nonpoint source pollution from silvicultural practices, with particular attention given to erosion control.

The above appendix, and the direction for its compilation by the Missouri Department of Conservation, reflects that agency's lead role in encouraging environmental sustainability on the state's nonindustrial private forestlands. In this regard, the agency has produced a booklet for distribution to landowners entitled "Missouri Watershed Protection Practice" (MDC 1997), which contains a set of management guidelines for maintaining forested watersheds to protect streams. Among the best management practices described therein are guidelines pertaining to topics presented in Table 14.

The combination of the silvicultural appendix to the MDNR's Nonpoint Source Pollution Plan and the guidelines for watershed protection published by MDC represent the core of existing 'best management practices' for nonindustrial private forestlands in Missouri. In accordance with its mission of providing guidance to private forest management in Missouri, MDC has provided the primary impetus for their development; while MDNR has incorporated these within the course of its mandate to ensure protection of the quality of the state's waters.

Historical evidence leaves no doubt that harvest and harvest-related operations have the potential to impact water quality and have done so on many occasions in the past. While there is no guarantee that the application of BMPs will protect water quality, many recent studies emphasize that the adverse effects can be greatly reduced by skilled planning and compliance with forestry BMPs (Curtis et al. 1991). The Governor's Advisory Committee strongly endorses the use of BMPs for all timber harvesting operations conducted in the state and encourages the agencies involved to continue to encourage this becoming a reality.

Table 14 . Best management practices described in MDC booklet for private forest landowners : *Missouri Watershed Protection Practice* (1997)

- Maintenance of *streamside management zones (SMZs)* -- SMZs are an area on both sides of the banks of streams where extra precaution is used in carrying out forest practices in order to protect bank edges and water quality.
- Construction of stream crossings

- Access roads and their construction :
  - Location
  - Grades
  - Curves
  - Road beds
  - Culverts
  - Dips
  - Water bars
  - Water turnouts
  - Shaping cut & fill slopes
  - Seeding for bank stabilization
- Timber harvesting :
  - Log landings
  - Site preparation
  - Reforestation
  - Practices to avoid
  - Prescribed burning and fire lines
  - Chemical treatments

At the same time, the historical legacy of poor forest management on the majority of the state's nonindustrial private forestlands remains. The question of how best management practices may become routine management practices conducted by Missouri forestland owners continues to be a topic of debate. In looking for guidance to other states that have addressed this problem, a mosaic of approaches may be found. Three general approaches to promoting the use of BMPs on private lands may be identified -- mandatory, contingent, and voluntary.

At present, 38 states have at least one program that regulates the application of forestry practices on private forestlands (Ellefson et al. 1996). Ten states -- including the three states on the West Coast and three in the Northeast -- have incorporated mandatory best management practices within comprehensive forest practice laws. These states have developed detailed rules that spell out permit application procedures and forest practice performance standards, including provisions for enforcement and penalties for violations. Other states have instituted mandatory BMPs, but not necessarily within the context of forest practice laws as comprehensive as those noted above. For example, Kentucky recently adopted mandatory BMP's on a statewide basis. The enactment of the requirement is accompanied by an adjustment period in which loggers are given the opportunity to receive training in the use of BMP's. By mid-2000, the state Forestry Commission will assume jurisdiction, and that agency will be responsible for inspecting logging sites for BMP compliance. The Kentucky Forest Industry Association supported that bill.

In the Kentucky example, loggers have understandably voiced their discontent about the new arrangement. This also happened, however, in Arkansas and Alabama where forest industry encouraged voluntary logger compliance with BMP's. Loggers did not like it then either. A representative from one of the chip mills in Missouri who addressed the Committee during the

hearings described his experience with the imposition of BMPs in the above states by noting that now they (i.e., BMPs) have become a way of life for the loggers, they have found out that, with a small amount of planning as they go along, the requirements are really not that burdensome. Many of the required practices are simple to do -- a skidder can accomplish them; and if the loggers finish an area -- i.e., close it out as they are coming out of a sale -- it actually doesn't take that much time.

Other states have adopted what may be termed as a *contingent regulatory model* with respect to the adoption of best management practices. In Montana, Virginia, Vermont and New Hampshire, state acceptance of voluntary application of BMP's is conditional on their widespread use by landowners and timber harvesters. If the state's lead forestry agency concludes that voluntary use of BMP's is unsatisfactory, penalties for noncompliance may be levied on those who are in violation of established forest practice standards. Some states, such as North Carolina, provide exemptions from NPSP laws if and only if forestry activities comply with "voluntary" guidelines (Deforest et al. 1989). Sentiment for this approach often occurs due to uncertainty over whether voluntary use of BMP's by landowners and loggers is sufficient to protect ecosystem values; a threat of regulation may be needed to ensure the application of such practices.

Most other southern and eastern states rely largely on non-regulatory means, i.e, voluntary BMPs, to control nonpoint source pollution from forestry practices. Voluntary BMP's and education are viewed as the best way to approach the problem by most firms in the wood products industry. However, some within the industry have accepted mandatory measures -- if not willingly, at least understandingly-- provided they are applied consistently to all who harvest timber. The concern here is that all loggers are treated in an equitable fashion , whether they're hauling to a sawmill, to a chip mill, or to a pulp mill.

States that adopt voluntary approaches to BMP implementation generally construct guidelines to aid landowners in applying such practices. The content and scope of such guidelines does, however, vary considerably. Thus, for example, Minnesota has adopted a comprehensive, user-friendly set of guidelines that is divided into two levels. The first is a set of 'general BMP guidelines' which are common to many forest management activities. These include such activities as conducting a site inventory; maintaining filter strips; managing riparian areas; protecting cultural resources; managing equipment, fuels and lubricants; protecting the normal flow of wetlands and streams, as well as wetland inclusions and seasonal ponds; retaining leave trees; providing coarse woody debris; and post-operational activities and follow-up visits. The second set is a collection of 'activity-specific BMP guidelines.' These include such practices as forest road construction and maintenance; timber harvesting; mechanical site preparation; pesticide use; reforestation; timber stand improvement; fire management; and forest recreation management (Minnesota Forest Resource Council 2000). The 450-page web-accessible voluntary guidelines does serve as a reminder of the need for continuing reexamination and improvement of both the content and form of any repertoire of best management practices.

All of the above suggests that there is indeed great variability between states and regions in terms of the mechanisms used to encourage implementation of best management practices on private lands.

In most states BMPs include such things as streamside management zones, wetland access systems, and proper harvesting and regeneration techniques. Many include limitations in the size of clearcuts. Like all states, the options in Missouri range across a spectrum that includes voluntary, contingent and mandatory approaches. The Governor's Advisory Committee has voiced support throughout its discussions for an emphasis on feasible voluntary approaches towards addressing problems involving the management of private forestlands. Education and training are obviously critical here (see Section E). But acknowledgment of the historical disinclination towards management on the part of the state's private forestland owners, as well as the ongoing need for refining Missouri's BMP repertoire, has led to some possible alternative courses of action being suggested. One potential action would involve establishing a forestry BMP board or commission to oversee and review BMP's and to aid in the development of a package which encourages environmental sustainability by considering the complete array of practices including, but not exclusively linked to, water quality. To varying degrees, such a board could also oversee the implementation and enforcement of such standards. Contingent BMP's constitute another possible option in this regard.

Other considerations pertain more directly to the enforcement aspect of the above. Paramount here is the question of dealing with landowners who, for various reasons -- particularly those grounded in interests tied to land speculation -- are simply unwilling to respond to any incentives that encourage the use of BMPs, or to anything, for that matter, that might add any costs to their speculative endeavors. One option here is to follow the lead of Tennessee and establish a "bad actor" designation -- in this case focused on loggers -- with civil penalties for operations which repeatedly violate, for example, water quality laws. Recommended by Tennessee's Forest Management Advisory Panel, this was instituted through a memorandum of understanding between the Tennessee Departments of Agriculture and Environment & Conservation. The former is to provide technical assistance to the Department of Environment & Conservation to promote full enforcement of these cases. The policy was endorsed by both the Tennessee Conservation League and the Tennessee Forestry Association.

A number of states have variations on the above approach, all of which represent potential alternatives for the above kind of policy. Some state agencies have felt it is critical to have the capability to suspend ongoing operations that are in gross violation of water quality laws. Other states allow for a reduction of penalties if remedial measures are taken immediately or within a certain time frame. In some states -- e.g., Kentucky and West Virginia -- landowners can be held legally responsible for allowing harvesting of their lands in ways that contribute to stream sedimentation or turbidity. Other options include establishing a tracking system for known violators or requirements that the state be notified before a 'bad actor' begins working.

Whether any or none of these options are pursued cannot be fully decided without consideration of the variety of economic incentives (section C) and voluntary education and training efforts for landowners and loggers (section E) that might be employed to encourage use of BMPs on private lands. As noted above, voluntary measures with a realistic chance of being successful are preferable to regulatory mechanisms, which serve as a means of last resort. At the same time, the need to continually assess the content of the state's best management practices as to whether they are making a difference or simply serving as symbolic tokens of good will remains. Are current BMPs really

working as designed? To what degree is their voluntary nature adequate, or should they be required by some means? Is on-the -ground monitoring adequate; otherwise how can anything even be said on the subject? Such questions are ongoing and no one has suggested that answers come easily. Yet it is only through satisfactorily answering these that the broader question of ensuring the environmental sustainability of Missouri's forest lands can be adequately addressed.

E. EDUCATION, TRAINING AND PROFESSIONAL MANAGEMENT

Missouri's nonindustrial private forestland (NIPF) owners are the silent majority in the state's forestry community. More than 300,000 in number, these individuals and groups control 85% of forestlands in the state, and four-fifths of them own parcels of 50 acres or less. How they perceive, value, and utilize their forest holdings will obviously be a dominant factor in the ecological and socioeconomic sustainability of Missouri's forests.

It has frequently been noted that NIPF owners in Missouri are on the whole not practicing good forestry. While such a criticism is in many ways justified, critics sometimes forget the diverse motivations and wide range of objectives held by landowners, and the fact that some are simply not interested in practicing 'good forestry' if the latter is equated exclusively with timber production. At the same time, it is also likely that many forestland owners do not know, or are only vaguely aware, that harvesting timber is not necessarily incompatible with other nontimber objectives, e.g., fostering viable wildlife populations, and may even enhance them. Providing landowners with such knowledge, always in a context of respect for their rights as property owners and objectives for forest ownership, is an important function of both public forestry professionals and private sector firms and individuals.

Several speakers in their testimony before the Governor's Advisory Committee observed that less than 10% of Missouri's private forestland owners are receiving the advice of a professional forester as input to decisions about whether and/or how they manage their land. Thus, for example, the Missouri Department of Conservation estimates that it makes about 28,000 contacts with landowners per year. Even if this figure excluded multiple contacts with any individual landowner, this is in fact slightly less than 10% of the state's more than 300,000 NIPF owners. However, several factors complicate efforts to pin down the actual extent of knowledge transfer that is occurring. On the one hand, not every contact likely translates into a significant 'learning experience' for the landowner involved. At the same time, it is certainly not necessary that every landowner be contacted every year. Moreover, it is also reasonable to assume that most landowners do not simply forget what they learned from such contacts by the following year. The overall level of 'landowner education' includes both knowledge acquired from 'new' individual contacts and knowledge retained from previous ones. Nonetheless, it is widely accepted that the overall percentage of NIPF owners receiving professional assistance is quite low.

It has also been noted earlier that the impact of Missouri's high capacity chip mills on the ecological and socio-economic sustainability of the state's forests will be mediated by how landowners respond to the demand for wood broadcast by the mills, and specifically by the kinds of forest practices landowners adopt in selling their wood for chips. In a real sense, therefore, the wood flow passes through the life of the landowner. Discussions centered on "education, training, and/or professional guidance" all have as their focus a common theme -- to help landowners cultivate a knowledge of their forestlands and how to care for them in a way which, when integrated with their personal desires and experiences, will help them make decisions about their forests whereby they may pursue their

goals in a socially and ecologically sustainable way.

This section considers several interrelated topics related to forestland owners, the loggers who harvest their timber, and the professionals who provide them with advice and assistance in managing their lands. All of the above are in turn situated within a context of a demand for wood that has recently been expanded by the arrival of two high-capacity chip mills in Missouri. Following a brief look at diverse motivations of the state's NIPF owners, attention turns to the status of landowner education and assistance efforts in the state, especially in light of the recent start-ups of the chip mill operations. The education of loggers who provide the direct linkage between the landowner's forest resource and the chip mill as a potential processor of its wood outputs is then considered. The section concludes with a discussion of forestry professionals and ways to ensure the continuing integrity of this longstanding profession in Missouri.

Landowner Motivations

The motivations of Missouri forestland owners and their interests and objectives for owning their lands are as diverse as the personalities and life histories of these people themselves. A first step in addressing the question of 'educating' landowners and providing them with technical advice and assistance in managing their forests is to understand how they integrate these lands in their lives.

In 1993, more than half of Missouri's nonindustrial private forestland owners questioned in an extensive survey indicated that the primary purpose for which they owned their forestland was that it was part of their farm (30%) or residence (25%).[19] Another 11% of landowners identified 'farm and domestic use' as the primary reason they owned their forests. In addition, almost one-quarter of landowners surveyed identified aesthetic enjoyment (15%) or recreation (9%) as their main reason for forestland ownership. At the same time, less than 0.5% of all owners listed timber production as their primary objective for land ownership.

If these results are viewed through the lens of *forestland area* controlled by owners categorized according to the same array of primary objectives as above, almost half of the state's total NIPF acreage is owned as part of farms (20%), for farm and domestic use (20%), or as part of residences (8%). Slightly more than one-quarter of the total NIPF acreage is owned for a primary purpose of either aesthetic enjoyment (11%) or recreation (16%). Finally, about 4% of NIPF lands in Missouri are controlled by owners with timber production as their primary objective. [Most of the remaining. NIPF acreages are owned for investment purposes (7%) or as part of estate holdings (7%).]

In this light, it is evident that for about two-thirds of forestland owners in Missouri, their forests are simply identified as either part of their farm or residence or as connected with farm or domestic uses. It is also clear that timber production is not the primary goal of the vast majority of forestland owners

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[19] Unless otherwise noted, most of the information on characteristics of Missouri's nonindustrial private forestland owners presented in this section on 'Landowner Motivations' is extracted from Birch (1996).

in the state. Aesthetic and recreational interests are the principal *specific* use objectives identified by landowners, accounting for about one-fourth of all landowners and a quarter of all NIPF acres. However, this disinclination on the part of landowners to identify timber production as a principal ownership objective does not necessarily translate directly into an unwillingness to *harvest* timber from their lands. In fact, 42% of the landowners in the above sample reported that they *had* harvested timber from their land at some time during their tenure (Table 15). On an acreage basis, moreover, owners who had harvested timber during their tenure controlled three-fourths of the total NIPF land area.

Table 15 . Timber harvesting history and intentions of Missouri private forestland owners, 1993. (Source : Birch 1996)

	(a)		(b)		
	Have harvested since owned land		Will harvest in future		
	Harvested	Did Not Harvest	1-10 yrs.	Indefinite	Never
Owners	42%	58%	38%	33%	28%
NIPF Acres Owned	75%	25%	59%	27%	14%

Several conclusions emerge from the above. Clearly the owners who have harvested timber control the majority of NIPF lands in Missouri. And although more than one-quarter of those who owned forestland in 1993 declared their intention never to harvest, they control only 14% of the total NIPF land base. Recent demographic figures indicate that there has been a net in-migration of people to the Missouri Ozarks, many of whom are coming from urban areas of Kansas City and St. Louis. Since recreation and amenity values tend to be greater for this type of landowner, it is possible that the 28% figure for owners intending never to harvest could rise somewhat in the future. At the same time, since many such owners are purchasing relatively small parcels, an increase in the 14% acreage figure may lag well behind any increases in numbers of owners in this category. This may be even more likely when considerations involving the turnover rate for forest lands are brought into the picture.

Table 16 contains some data that was recently reconstructed to provide an estimate of length of land tenure for NIPF lands in Missouri. Based on the landowner survey of 1993 (Birch 1996), it was estimated that over 70% of all NIPF lands in the state had been acquired by their present owners since 1960. More than half of the total NIPF acreage had come under its current (i.e., 1993) ownership

Table 16. Length of tenure for the average acre of private forestland in Missouri, 1993 (Constructed from Birch 1996)

Year of acquisition	Median year	Mean length of tenure in 1993	Acres (M)	% of acres	Cumulative % of acres
90-94	92	1	252	2	2
80-89	85	8	1661	15	17
70-79	75	18	3070	28	45
60-69	65	28	2869	26	71
50-59	55	38	1765	16	87
40-49	45	48	654	6	93
1901-1930	15	78	705	6	99
Prior to 1900	1880	113	101	1	100
Total			11077	100	

Mean length[a] : 28 years Median length : 26 years
Proportion of land reaching market each year : 1/28 or 3.6%

[a] This was obtained by : 1) Weighting the total acres falling within each 'year of acquisition' category by the mean length of tenure (as of 1993) for that category [for example, for the 'year of acquisition' category 1990-94 -- i.e., row 1 -- this figure for "age-weighted acres" would be : 1 x 252 (thousand) = 252 (thousand); 2) summing the "age-weighted acres" for all 'year of acquisition' categories -- i.e., rows in table; and 3) dividing that sum by the total NIPF acres in the state -- i.e., 11,077,000.

in the 1960's and 1970's. From the figures in Table 16, the average length of tenure for an acre of Missouri NIPF land was calculated to be 28 years.[20]

In terms of potential availability of timber from NIPF lands in the state, the following conclusions may be drawn from tables 15 and 16. Given that owners of three-fourths of the state's NIPF acres have harvested timber in the past, and that owners of three-fifths of the total NIPF acreage in the state (at a minimum) have indicated an intention to harvest timber in the future, then clearly the majority of acres are in a status in which some harvesting will take place. When added to this is the above conclusion that an *equivalent* of the total acreage of NIPF lands in the state is going to change ownership in the next 30 years [obviously not every individual acre; some land will turn over more than once] -- and thus that such an amount will turn over three times during the next 100 years -- then it is reasonable to assume that an equivalent of the total NIPF acreage in the state will be available

[20] Calculations were performed by Shifley (1999). As noted earlier, this period is substantially longer than the rate of 7 years for that was cited frequently during hearings conducted by the Governor's Advisory Committee. As described above, however, it does not invalidate the assumption derived from it that was used in the analysis and projected scenarios in Section A -- i.e., the assumption that an equivalent of close to 100% of the total acreage of NIPF lands in the state is going to turn over (likely more than once) during the next 100 years.

for harvest in the long run.

The implications of the above are numerous and cannot be analyzed in detail here. A few initial observations can, however, be offered. First, the implications for timber availability from NIPF lands appear to be rather straightforward from the above discussion. There will likely be an amount of NIPF acres potentially available for timber harvest during the next century *equivalent* to the total acreage of these lands in the state, despite the fact that timber production is not the primary purpose of land ownership for most NIPF owners. This does not mean that every acre of NIPF lands will be harvested, but that over time a total acreage *equivalent* to all NIPF acres will potentially be available for harvest, given the combination of owner turnover rate and landowner motivations in terms of willingness to harvest timber.

At the same time, the implications for nontimber forest resource uses -- a likely principal objective for one-quarter to one-third of the state's NIPF owners over the next century (but who control less than one-fifth of the state's total NIPF land base) -- are muddled at best. It is most unlikely, for example, that lands owned by this group will remain exclusively within that group itself. In fact, for owners who don't harvest, the timber resource will presumably become more valuable during their period of tenure, perhaps making their land more attractive to prospective buyers willing to harvest timber when that land does come onto the market. Moreover, it is generally accepted that timber harvest is more likely to be conducted just prior to or just after forestland changes hands. Also, for many owners timber harvest is a once-in-a-lifetime venture. Further complications enter when one tries to analyze the situation from the perspective of some of the larger-scale ecological factors discussed in the last section. This situation raises questions about certain large-scale ecological issues -- e.g., habitat diversity, integrity of diverse ecosystems, etc.-- and the future impact of hundreds of thousands of independent landowner decisions on the forest landscape. In this regard, the comments of Barclay (1999) are particularly relevant, in noting that "state natural resource agencies and the Forest Service should determine what industrial timber owners propose to do with their forests (i.e., how they will be managed), *factor in nonindustrial forest landowner trends*, and then manage public forestlands to meet the remaining ecological needs on a regional basis."

This by no means, however, implies that encouraging ecologically sound management on private lands will not play a major role in the long-term ecological sustainability of Missouri forests; or that ecologically sustainable practices should not be an essential part of landowner education and technical assistance efforts. What it does recognize, however, is that even though non-consumptive uses (and related interests in ecosystem values) are a primary objective for almost one-third of Missouri landowners, and are significant as well to many others, the dynamics of thousands of individual land use decisions on the part of Missouri forestland owners has no inherent logic in itself that will automatically generate a situation in the aggregate that equates to broad-scale ecological sustainability. This in turn suggests that explicit attention ought to be given *now* to ensure that the 'whole' which emerges from this long-term process driven by land use decisions and turnover of private lands does not simply turn out to be the 'sum of the parts,' because ecological systems and processes are by their very nature not simply mere aggregates of parts.

What does this have to do with chip mills, and the 'chip mill issue' in Missouri? Just as with virtually all of the topics related to environmental sustainability discussed in the last section, the impacts of the mills on Missouri's forest resources will be felt in the practices landowners use in responding to the demand for chips. When those practices are 'plugged into' larger-scale phenomena like forest fragmentation and ecosystem integrity discussed above -- that is to say, when they become part of the hundreds of thousands of harvesting decisions of NIPF owners which in the aggregate will play an important role in the overall sustainability of Missouri forest landscapes -- the contribution they make towards achieving that end can either strengthen or weaken ecological sustainability, depending on the practices landowners actually use in responding to the demands of the mills. In this regard, the kind of pattern that becomes established in landowner (and logger) relationships with the mills will surely be important.

Finally, all of the above serves as a reminder of a point emphasized at the beginning of this report -- i.e., that the 'chip mill issue' is by its very nature deeply embedded in much broader questions involving the management of *all* of Missouri's forestlands. Much more analysis needs to be conducted in order to better understand the implications of the complex interrelationships among landowner motivations, forestland turnover, and ecological and socio-economic sustainability of Missouri forests. The above discussion has only skimmed the surface in this regard.

Landowner Education and Assistance

There are many ways in which both public and private collective efforts may be organized to provide landowners with education and assistance in managing their forestlands. On the one hand, in designing effective education programs, much time and effort are involved in constructing program content and putting together effective learning materials. Reaching landowners who might attend classes, seminars, or demonstrations is challenging and often logistically complicated. In particular, allocating the manpower necessary for effective one-on-one communication with landowners is an expensive process that competes with other organizational (and societal) priorities. In fact, disseminating information to forestland owners in general, whether it describes sound forest management practices for timber and/or other resource objectives or various kinds of incentive programs available to landowners, can become expensive and inefficient if not directed towards those owners who are more likely to be receptive to those efforts, or at a minimum those who together control a greater proportion of the forestland base.

Equally challenging is the provision of technical assistance to forest landowners. At the field level, for example, a forest inventory may be involved -- a laborious process which may take several days or weeks. Helping a landowner develop a management plan, which always entails keeping that individual's interests in the forefront, may involve more days and weeks Even then, the process may always break down. Sometimes a professional forester may invest months in helping a landowner adopt sustainable forest management practices, only to see those efforts go for naught when the land changes hands. But despite these and other difficulties inherent in involving efficient and effective educational and technical assistance resources for Missouri forestland owners (and those in other

states where similar problems are also invariably encountered), most resource professionals favor these approaches as the first line of offense in promoting sound management on private lands. A 1995 study of state forestry program managers across the country revealed that educational and technical assistance programs were rated considerably higher than voluntary guidelines, regulatory measures, and fiscal or tax incentives in terms of their effectiveness in promoting sound forest management (Ellefson et al. 1995). The Governor's Advisory Committee strongly endorses efforts to enhance the quality of such programs in Missouri.

Among the major actors in the state with a role in landowner education and the provision of technical advice and assistance to forestland owners are the Missouri Department of Conservation (MDC), University of Missouri Outreach & Extension, and the Missouri Forest Products Association (MFPA). The Missouri Consulting Foresters Association and its members also play an important part in this process.

Missouri Department of Conservation. The kinds of difficulties faced by public agencies in delivering effective educational programs and technology transfer are no more evident than in the progress report for educational efforts of the Missouri Department of Conservation for FY 1998. The report was straightforward about the inadequacy of existing programs and funding levels. With little or no promotion, staff satisfied 20,000 requests, and landowners still frequently found themselves having to wait three to six months for assistance. Less than one-half of 1% of Missouri's land was directly impacted, with only 2% directly impacted through other agency partnerships. The agency concluded that new techniques and materials to encourage private land management needed to be developed and funded; and that private land staff specialists should be placed in key positions to facilitate a total resource focus and open communication.

As noted earlier, MDC estimated that it made about 28,000 contacts with NIPF owners in the state during FY98. The Department provided direct forestry assistance to more than 1500 individual landowners. This was in the form of one-on-one contacts and ranged in substance from the identification of trees and plants to detailed natural resource management plans. In this regard, the Department had earlier developed a Forest Stewardship Program to encourage sustainable management of all forest resources in accordance with landowner expectations and goals. The program focuses on all forest resources, providing owners with opportunities to manage their woodlands for soil and water protection, aesthetics, forest improvement, tree and windbreak plantings, wildlife habitat, fish habitat, and sustainable forest products. The key to the program's effectiveness is the landowner forest stewardship plan. In FY98, there were 325 landowner forest stewardship plans developed affecting 45 thousand acres. This brought the total enrollment in the Forest Stewardship Program to 2431 landowners and 329 thousand acres.

The Department of Conservation also conducts a variety of educational programs and activities for Missouri forestland owners and interested citizens. Table 17 provides capsule summaries of the principal activities of this nature in which MDC is involved.

Partly in response to MDC's honest appraisal of the difficulties it was experiencing in carrying out

Table 17. Forestry Education Programs and Activities of the Missouri Department of Conservation

Master Tree Farmer : This landowner education program was developed in southeast Missouri and is jointly taught by MDC and University Extension. Landowners attend a 3-hour class for 12 consecutive weeks. Course content includes forest ecology, forest protection, best management practices, developing a plan, marketing and taxation. One class was held in 1997 with about 30 landowners attending.

Master Woodland Steward : This course is very similar to the Master Tree Farmer program and was developed at about the same time. One session was held in Warren County with 30 landowner attendees.

Landowner Seminars and Field Days : These programs are initiated by regional personnel and are held as often as landowners' interests dictate. The seminars and field days are usually one day or an evening in length and have a single theme. Some of the topics covered in the past workshops include agroforestry, walnut management, special forest products, hardwood management, tree planting, and pest management.

Forestkeepers : This is a voluntary forest health monitoring program. About 1000 individuals, classrooms, and other groups have joined the program. Forestkeepers select a woodlot or street trees to monitor each year to assess the long term health of those trees. Additional training is planned for those who want to become more involved with monitoring, management and assisting others with their trees.

Project Learning Tree : An interdisciplinary curriculum for teachers, youth group leaders, and resource professionals. Hands-on activities teach students about trees, forests, soil and water conservation, and wildlife. About 300 educators attend PLT training each year and they reach about 6000 students.

Forest Management Curriculum : This curriculum was developed by MDC and is distributed to vocational-agriculture teachers by the Instructional Materials Laboratory at the University of Missouri. It is a semester-long course that can be substituted for the plant science requirement in vo-ag curriculums. In forested parts of the state, trees are a better teaching connection than row crops. The course of study includes tree identification, forest ecology, forest protection, thinning and harvesting practices, and careers.

FFA Forestry Contest and Summer Camp : Working with FFA members is a way to educate the future landowners. Locally, foresters help train forestry contest teams. The contest varies from year to year, but usually includes a test of forestry knowledge and practicals on tree identification, thinning, and cruising. The teams compete on regional, state, and national levels. Many FFA chapters also attend summer camp at the Lake of the Ozarks. During each week-long session, a half-day is devoted to conservation topics. In a five-week camping season, about 700 FFA members are being reached through these programs.

Guide to Marketing Timber packet : This packet is a collection of guidesheets to help landowners who are selling timber. It contains advice on selling timber, sample contracts, contact information for MDC and consulting foresters, tax information, and recommended BMPs. Available from any MDC forestry office.

Publications and Web Page : MDC has a variety of publications on forest, fish and wildlife management. Many of these are written in 'guidesheet' format to assist with land management decisions. Most of the publications are free and are available from MDC offices or on the MDC web page.

educational and assistance functions as part of its mandate, on October 29,1999, the Conservation Commission created a new Private Land Services Section within the agency. The Section was established at the request of the Director after receiving considerable input from staff at all levels concerning how to best address resource management on private lands. The new section will have primary responsibility for providing information, education, and assistance to the state's private forestland owners. Its administrative structure includes a Section Chief and three Private Land Program Supervisors based in Jefferson City. They will coordinate and cooperate with the other agency divisions and sections to develop and implement Department-wide private landowner assistance programs. From 35 to 37 additional resource professionals will be added at the field level to provide direct landowner assistance in the Department's ten regional areas. They will work in teams with wildlife and fisheries biologists and foresters to assess and direct assistance efforts based on local resource and landowner needs.

Among the goals of the program are to increase the current level of 28 thousand landowner contacts per year by an additional 48 thousand contacts annually. Local teams of Department resource professionals plan to attempt to contact all landowners who own ten acres or more and to provide them with information, education or assistance appropriate to meeting their resource management objectives. A Department-funded cost share program has also been established to assist forestland owners in conducting resource management activities. Department resource professionals will receive training in all resource disciplines, as well as in the areas of customer service, public and media relations, and public speaking. An additional program goal is to help the Department become more visible and available to commodity farmers and other traditionally agricultural-based owner/producer groups, both at the level of the individual landowner and by working more closely with these organizations to develop programs that better meet their needs.

Through its Private Land Services Section, MDC also plans to develop curricula and programs to enhance education efforts directed at both landowners and students. In addition, an internal system of tracking landowner contacts and accomplishments is currently being developed. The Department is also investigating methods to survey Missouri citizens and landowners about resource issues and needs to aid in the content and focusing of assistance programs. This is closely linked with efforts to expand the ability to measure and/or assess diverse resource characteristics such as biodiversity, amenity values, consumption patterns and changes in these and other variables. The recent commitment of staff and funding to continue the statewide Forest Inventory and Analysis (FIA) and Forest Health Monitoring (FHM) programs, as well as ongoing surveys and other research efforts related to fish and wildlife resources and timber products, as well as the agency's participation in the Missouri Resource Assessment Partnership (MORAP), are all intended to bolster the Department's mission of enhancing the long-term sustainability of both public and private lands in Missouri..

University Extension. The Outreach and Extension Service of the University of Missouri -- Columbia and its affiliates offers an extensive array of resources that have an important role to play in educational efforts directed towards Missouri's private forestland owners. The Extension Forester disseminates a wide variety of technical information on forest management practices and the state's wood products industry; and also organizes periodic meetings and conferences on forestry-related

topics. More generally, Extension provides the most concentrated focus in the state on the construction and delivery of programs the central purpose of which is the transfer of knowledge. A noteworthy example of the above that focuses on providing education in forest management to the private forestland owner in Missouri is the Master Tree Farmer Program.

The *Master Tree Farmer Program* was developed in Southeast Missouri and is jointly administered by University Extension and the Missouri Department of Conservation, with the former assuming the lead role. In this program, landowners attend a series of three-hour classes for twelve consecutive weeks. In return they volunteer their time to communicate what they have learned to others with an interest in learning about forest management. The content of the course includes an overview of Missouri forests ; basic functions of the forest; silvicultural practices; forest resource protection, including fire management & control, forest insects and diseases, and the use of best management practices; watershed and wildlife management; developing a forest management plan; wood products marketing; taxes and estate planning; natural history; and urban forestry. Several field trips to private and state lands are conducted during the course to demonstrate different harvesting practices and their management.

The objective of the program is not to tell landowners the way to manage, but rather to present all the options an owner may have to manage his or her forestlands -- e.g., no cutting; uneven-aged management; and even-aged management. A primary goal of the program is to present consequences, pros and cons, of alternative management decisions. The course has been offered twice to date, with enrollments of about thirty landowners each year. A third course is planned for the first part of the year 2000.

In contrasting this kind of program with traditional landowner outreach methods, the focus is to educate landowners so as to enable them to make many of the decisions involving forest management independently. In contrast to merely reacting to landowners who request help, the emphasis revolves around equipping forestland owners with a repertoire of decision making tools and resource management perspectives so that they may both operate more independently and seek professional assistance, should they desire to again, on the basis of a well-rounded perspective of the important concerns of forest management.

While the content of the Master Tree Farmer program is exceptional -- and represents the kind of quality curriculum development at which University Extension has long excelled -- the reality is that the above kinds of quality landowner education efforts are estimated to be reaching about only one to two percent of private forest landowners in Missouri. It is difficult to estimate how many acres of forest lands have actually been affected by these programs. Some of the participants have taken advantage of assistance programs before; others have not. Some participants own no land at all; some are interested in buying land. The diversity of participants complicates the assessment of on-the-ground program impacts.

Missouri Forest Products Association. The Missouri Forest Products Association has been connected with educational activities for some time. One program that has been in existence for more

than 50 years is the *Tree Farm Program*. This is a long-term program in which people enroll their *land*. The Program is a joint venture sponsored by the MFPA and the American Forest Foundation. Individual landowners are recognized with statewide and regional awards. MFPA has also conducted a number of landowner informational packet programs over the years using resources from a number of other agencies and groups.

An MFPA Task Force on landowner education met for the first time in the summer of 1999. A committee was formed which includes representatives of the University Extension, the Missouri Department of Conservation, the USDA Forest Service, and the Farm Bureau with the goal of putting together a common program or set of programs dealing with landowner education. Two key needs that were identified by this group included a statewide landowner education program for Missouri and an industry-led logger education program. The need to undertake a pilot program was also recognized, a step considered important for local landowner involvement. Another option that merited consideration was the formation of a council made up of landowners who would help revise and improve the landowner education program.

MFPA has also voiced its support for the landowner outreach component of the Sustainable Forestry Initiative (SFI) of the American Forest and Paper Association. In particular, it favors SFI's emphasis on "teachable moments " -- i.e., having a person's totally undivided attention. The goal of SFI landowner outreach is for its member companies to use teachable moments in which the company forester, one-on-one with the landowner, conveys to that individual information on sustainable forestry and resource management. Some of the tools MFPA hopes to utilize as part of the overall program it hopes to develop include brochures on BMP's, reforestation and other topics, as well as conversations with landowners about their management objectives.

Forestry Consultants. A fourth group that plays an important role in providing educational opportunities and technical assistance to Missouri forestland owners is the state's association of consulting foresters. Currently there are 40 forestry consultants listed in the Missouri Consulting Foresters Association membership directory. These professionals are generally self-employed and offer their services on a fee or contract basis.

The services provided to landowners by forestry consultants involve all facets of forest management. Among them are included value appraisals and/or inventories of forestlands, silvicultural practices, assistance to landowners in developing resource management plans, and marketing assistance for selling forest products. In addition, some consultants offer specialized services such as real estate appraisals, landscape planning, environmental impact statements, and specialty product marketing. With their background of technical training in forest management, consulting foresters represent an important component of the state's forestry community.

Program Content and Delivery. A question often asked in connection with the kinds of programs described above is whether effective landowner education consists of different programs for different people, or a kind of prototype education program where 'one size fits all.' In light of the diversity of landowner objectives noted earlier, one might be tempted to say that landowners vary so greatly

in their motivations for forest ownership that different approaches will likely be required to reach different groups of owners. Thus, for example, the Master Tree Farmer Program might be most effective at reaching one group of landowners that is somewhat more interested in management and perhaps slightly more attuned to ecology and/or environmental aspects of land ownership. Another program, such as one in Arkansas entitled "Top Dollar for Your Timber," would more likely appeal to another group of forestland owners -- i.e., more traditional agriculture-oriented individuals who may or not be as interested in learning about the ecology and silvics of their forest lands. At the other end of the spectrum is a group that would likely be quite receptive to MDC's *Forest Keepers Program*, which is geared towards people who are interested in forests for their own sake. In this program, participants receive some tools and instruction to help them pursue their interest in simply monitoring the health of the forests in their area. The conclusion that emerges here is that it is not likely that one type of program fits all. Landowners have a wide range of interests, and different groups will likely be more receptive to slightly different approaches. In addition, many landowners may evolve from one approach to another over time. Thus, for example, some may participate in Forest Keepers for a year or two and then become interested in becoming a Master Tree Farmer.

Somewhat in contrast to the above, one could recognize differences in landowner motivations but argue that rather than developing entirely different programs, there are advantages to incorporating diverse landowner interests within one program; with great attention given, however, to flexibility in stressing different program components for landowners groups with different interests. The Master Tree Farmer Program comes closest to this kind of example among those that were discussed above. This would also be conducive to approaches in which agencies work together, perhaps within the kind of a framework advocated by the MFPA's education committee, thereby decreasing the natural tendency for individual organizations to try and 'do it all themselves' and in the process stretch themselves too thin.

Shifting further towards questions of program delivery, many would argue that what is important in delivering landowner education and assistance is to reach the landowners who are going to make decisions about resource management; or if they don't intend to do anything, to help them become more aware of the multiple array of values present in their forest lands. A key question regarding program delivery concerns how the organization providing the education or assistance positions itself to 'be there at the right time.' As was mentioned during the Committee hearings, there is really very little way in Missouri to know exactly when a harvest takes place. State agencies such as the Missouri Department of Conservation are for the most part forced to guess how much harvesting takes place in the state in the short run. Moreover, forestland owners are not always interested in obtaining information about forest management until they are ready to do something with it. Inability to resolve this challenge of 'being there at the right time' -- preferably at the inception of harvest planning, but at a minimum prior to the actual harvest itself -- to deliver information to landowners that might help them make informed management decisions has been one of the more intractable problems that has dogged the delivery of education and assistance programs to landowners in Missouri over the years.

One alternative that was suggested to the Governor's Advisory Committee involved establishing a

requirement that a landowner file a notification of intent to harvest timber for sale. Such a harvest notification system could be administered by local MDC Forestry District offices, and would provide a mechanism whereby the agency could ensure that all landowners contemplating timber harvesting received information on sound forest management in a timely manner. At the same time, not knowing *where* harvesting occurs until long after the fact also severely complicates the task of assembling information for landscape-level assessments of resource availability and ecological integrity, and the harvest notification process would address that difficulty as well. It could also, but need not necessarily, be used to provide a mechanism to insure compliance with best management practices, should it be decided that the monitoring component of a program to ensure the use of BMPs for timber harvests be approached in that fashion.

Most proponents of harvest notification are impressed with its efficiency. They observe that it can conceivably do at least three things at once, and at a relatively modest cost of administration. Opponents, however, tend to view it as an unwarranted infringement on landowner privacy and decision making. Both views were expressed by members of the Governor's Advisory Committee, along with a more practical assessment that it was doubtful the idea would receive extensive support from a state legislature steeped in a strong property rights tradition.

When the two key features of program content and delivery are considered together, as they must be in any effective education or technical assistance program, and time is added to the equation, the following picture emerges in terms of the kinds of approaches that may be adopted in attempting to improve the status of landowner education and assistance for forestland owners in Missouri. The topic of landowner education and assistance is not a novel one in Missouri. For at least two decades, if not longer, it has been a subject of attention and an area in which it was agreed that improvements could be made. With respect to education, everyone favors a comprehensive program content capable of accommodating the wide range of objectives held by forestland owners. Interactive educational settings and field trips to sites where a range of forest management practices can be witnessed are also strongly favored by most. Unfortunately, the expense and logistics of putting together such programs (as, for example, the Master Tree Farmer program) have resulted in their reaching only a minuscule portion of forestland owners in the state.

With respect to technical assistance, one-on-one contacts with landowners in the field, clearly the most effective and desirable way to deliver assistance, is at the same time an extremely labor intensive and expensive endeavor. The resource foresters for the Missouri Department of Conservation are a group of dedicated professionals performing exceptionally with the resources they have. As noted earlier, however, a relatively low percentage of the state's NIPF owners are being reached, and many with whom contacts are made must wait for assistance. The recent creation of the Private Land Services Section within the agency will surely aid in alleviating immediate stresses, but it cannot be expected to resolve the current situation entirely. Finally, although some potential finding sources have been discussed, a realistic look at the financial horizon does not reveal a significant source of funding in the clouds.

Given this scenario, several factors related to program content, delivery, and cost merit brief

attention. The Committee agrees that the primary focus of initial landowner education and assistance efforts should center on the source areas of the two mills. Their recent arrival, and the certainty that landowners will interpret the demand for chips emanating from the mills in different ways, would suggest that landowner education and assistance efforts to enhance the possibility of informed forest management choices begin at the source of the stimulus. With this established, two perspectives varying by time frame and extent of targeted landowners within this area exemplify possible ways of approaching the problem. The first reflects a short-term view and encompasses all forestland owners in the respective source areas. Given the uncertainty as to how landowners will respond over time to the demand for chips by the mills, and in light of the limited available information indicating that landowners in another state (Arkansas) did not practice good forest management in responding to chip mill demands, this more cautious approach would target all NIPF owners in the source areas to receive a modest packet of information on forest management that may better help them evaluate their options in interpreting and responding to demands for chips by the mills. In testimony to the Governor's Advisory Committee it was noted by several speakers that the Farm Service Bureau has the most comprehensive list of landowners (e.g., farm/forest; resident/absentee; etc.) of which they were aware. Utilizing such a list, NIPF owners could be mailed the management information packet. This would ensure that in the short-run all landowners would receive at least *some* information which they can utilize to help construct a realistic picture of all their options that includes and situates the demands for wood chips. This is obviously a short-term potentially educational experience, but it does have the advantage that it can be accomplished completely.

A second perspective could be viewed as more long-term in nature and targets a sub-population within the two source areas. It would also allow continued emphasis on the development and delivery of high-quality education and assistance programs with the aim of maximizing the educational experience of forestland owners. Since larger acreages will contribute to a greater net impact when harvested in response to chip mill demands, and the resultant resource impacts will be proportionally greater than on smaller holdings, then the logic here is to target more in-depth educational and assistance to owners with larger landholdings. Thus, for example, landowners with a minimum of 40 acres (and perhaps a maximum on acreage size as well) could be targeted for educational and/or assistance programs. One way this could be done is through a pilot project. Both the short- and longer-term perspectives for structuring education and assistance efforts in the source areas for the chip mills were discussed by the Committee as exemplifying possible ways to approach the complex question of landowner education in the context of the chip mills in southeastern Missouri.

Finally, given the inability of any of the primary actors involved in landowner education and assistance to address this massive challenge alone, the strategy utilized by the Missouri Forest Products Association of bringing significant potential program delivery groups together to examine how a combined effort might be pursued would appear to be a worthy one. One advantage of a cooperative approach is that different participants may contribute specialized strengths and/or skills, and the resultant package may be stronger because of that. Thus, for example, University Extension, with an office in every county and expertise in the development of classroom interactive educational settings would appear poised to make a strong contribution to the combined product in those areas. The Missouri Department of Conservation clearly has significant expertise in the area of technology

transfer when it comes to interactions in the field and demonstration of on-the-ground management practices. The Missouri Forest Products Association has a traditional relationship with loggers that could serve as a basis for taking the lead in logger training activities. And there is always a role for consulting foresters in the process. Blending the particular strengths of each participant organization in the cooperative task of landowner education and technical assistance will likely always remain a viable option.

Logger Training

Loggers are a critical part of the landscape of Missouri forestry. The logger is the intermediary between the forestland owner who decides to harvest timber and the sawmill or chip mill that processes the wood. It is the logger, moreover, who is directly responsible for 'leaving' the environmental impacts of harvesting -- whether they be the 'traces' of a properly conducted harvest (even careful selection harvesting leaves some impacts) or severe erosion from an improperly conducted clearcut. In addition, the logger frequently assumes a distinct position in the process of *economic* transactions through which wood flows from private forestlands to the mills. With respect to the chip mills, for example, it was noted earlier that landowners frequently sell their timber directly to loggers, who then deliver the wood to the mill as 'gatewood,' in the process initiating a separate economic transaction in selling what is now ***their*** wood to the mill. When the chip mills contract directly with the forestland owner for the timber on his or her land, the logger does not assume this intermediate role of wood purchaser, but rather contracts with the mill strictly as a provider of services in harvesting the timber.

In either of the above roles, the logger plays a critical function in the flow of wood from the forestland owner to the mill. The character of logging practices conducted in the state will have a lot to do with whether sustainable forests become a reality in Missouri. With respect to the chip mills, given that they are more likely to encourage clearcutting than selective harvesting (this is not only true purely from a practical perspective, but was also borne out in the results of Gulden's modest study in Arkansas -- see Table 7), it follows that how loggers conduct such clearcuts is an important aspect of the 'chip mill issue.'

On its field trip in June,1999, the Governor's Advisory Committee witnessed two contrasting examples of how clearcuts could be conducted. The Nelson tract, in which the harvesting operation was conducted under the oversight of the Missouri Department of Conservation, represented a good example of a well-conducted clearcut. Contoured to the landscape, it met virtually all of the criteria encompassed by the standard understanding of "best management practices" described earlier. The Funk Branch tract, however, left much to be desired in this regard. There was severe rutting from the skidders. Because the roads had been wet during at least part of the operations, much of the soil that was on the roadbed had been graded up onto the side of the road -- i.e., the soil (mud) that was pushed out of the roads was pushed up onto the landscape. Logs were left on the site that were cut but not skidded. Some small draws and ravines had been used to skid logs down, as opposed to pulling or yarding (i.e, cabling) logs out the ravines. The log landing sites were located too close to

the creeks. And finally, there appeared to have been little or no pre-harvest plan or lay out at all, which would have included adequate skid trails and log landings.

The same contrast between sound and unsound logging practices applies to uneven-aged management techniques as well. In oak forests, for example, proper harvesting practices can ensure that the residual stand, including the critical regenerative component of young seedlings, is protected during logging operations. Unsound practices can damage such sites to such an extent that undesirable species end up dominating the regeneration process, in addition to those practices possibly contributing to other ecologically damaging outcomes like soil erosion. There is no question that an expert logger can extract timber from a stand while preserving both stand structure and the ecological integrity of the site., or can conduct a clearcut in a manner that ensures regenerative response while preserving its key ecological attributes. But this does not always happen with forest practices in Missouri. One way to increase the likelihood that it does is to ensure that all loggers are trained in proper forest management and logging practices. A second related way is through a process of logger licensing or certification, for which completion of some form of logger training program would invariably be a part. This subsection looks briefly at those two interrelated ideas.

It is estimated that there are between 800 and 900 loggers in Missouri. The Missouri Forest Products Association (MFPA) has instituted a voluntary training program for loggers in the state, for which they are awarded a certificate for successful completion. The program reflects MFPA's endorsement of the Sustainable Forestry Initiative (SFI) of the American Forest &Paper Association, including SFI's logger outreach component. The logger training program of MFPA is divided into two segments: a) forest management; and b) best management practices, with particular emphasis given to controlling erosion from timber harvests. The principal activities that comprise the subject matter of the program include:

- Skid trail location
- Use of water bars
- Use of SMZ's (streamside zones)
- Buffer strips for visual management
- Seeding trails & landings
- Recognition of erosion potential
- Sediment runoff controls
- Den trees and other wildlife vegetation

Every effort is made to limit the size of training classes to approximately twelve individuals. This is considered desirable to facilitate a more interactive learning experience for loggers. MFPA sends out press releases to all rural and metropolitan newspapers to help loggers become informed about the timing and location of classes.

As of mid-1999, about 200 loggers in Missouri had completed training under the program In terms of their reactions to the experience, MFPA reports that when the class first started many loggers questioned how it could possibly benefit them, given their lengthly experience as 'professionals' in the field; but that upon attending the program, most found that it had many valuable things to offer. The pattern has been that there is often a core group of experienced loggers who begin talking to their peers, and word of the program spreads.

The logger training program initiated by MFPA is voluntary in nature. Even though the Board of Directors and the Education Committee of MFPA has not wanted to be seen as forcing certification for loggers, MFPA does issue a certificate to show they have completed logger training. However, its voluntary nature, and the natural disinclination of many loggers to feel that they need to go through such an exercise, raises questions as to the kinds of incentives that would convince loggers to participate. As with most other matters involving compliance with rules or desired standards of behavior, the idea of providing voluntary incentives for participation in the training program is looked to first. Thus, for example, the Missouri Department of Conservation has announced its intention by July 2000 to use only trained loggers for timber harvested on state-owned public lands. A somewhat different kind of incentive may be found in the actions of the Missouri Wood Industry Trust, which is now offering a base rate of 20% of workman's compensation to loggers who have completed the training course, or who have made a commitment to complete the course. Prior to logger training, there was a 40-50% base rate for workmen's compensation. This is a significant savings and certainly serves to promote the program.

At the same time, it is generally agreed that there "needs to be teeth" in any program to formally certify loggers. Moreover, it has happened that loggers from out-of-state have come to work in Missouri, with little regard for BMPs or other sound forest management practices. Such situations could likely only be effectively addressed either by making training mandatory or requiring a license for loggers. A registration or licensing process can facilitate this end. A question remains, however, as to from where such a 'push' should emanate.

In general, there are three critical questions that pertain to ensuring the integrity of any profession -- in this case, for the occupation of logging.

a) What are the standards according to which those providing logging services can or should be measured?
b) Who sets such standards?
c) How is adherence to standards monitored and ensured?

These questions would pertain not only to loggers and the logging profession, but in effect to any profession. Shortly they will be discussed in relation to certification of professional foresters.

A first point when considering the idea of licensing loggers is that there is a fairly well-developed terminology associated with licensing and related activities. All such terms may be viewed as variations of the umbrella term "credentialing." Attention here focuses primarily on loggers; but the general set of terms described below was originally described with respect to foresters and will be considered relative to forestry as a distinct profession in the next subsection. Moreover, the terms described below may be viewed as characteristic of how any profession may be approached.

Credentialing programs have typically been described in three different ways -- as registration, licensing, or certification programs.[21] Often the terms are used synonymously, but they actually

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[21] The following discussions on logger licensing and forester certification are taken from French (1999).

reflect subtle differences, which are depicted in Table 18. *Registration* is generally a voluntary procedure, often administered by a state agency, whereby an applicant is recognized as having met certain professional standards defined in terms of education and/or experience. A person may practice his or her profession whether or not he or she is registered, but registration does confer a state-sanctioned status upon the individual confirming his/her abilities to practice that profession. When registration is mandatory, then it is customarily referred to as *licensing.*

Table 18. Forms of credentialing programs. (Source : French 1999)

registration : Normally a *voluntary* procedure that requires a person to meet certain standards
- Procedure usually administered by a state agency
- Serves as means to identify individuals who have met specific standards of professional education and/or experience deemed necessary to provide services associated with that profession in that state.
- When mandatory, is referred to a licensing, and individuals who are registered are often said to be 'licensed'

licensing : A *mandatory* procedure that requires a person to meet certain standards and grants them permission to perform certain acts
- Licenses usually issued by a government agency or by a legal authority
- Permission to practice usually withheld from unlicensed individuals

certification : Usually a *voluntary* procedure attesting that a person has attained certain standards.
- Certification usually conferred by a peer group or organization
- Persons may practice without certification; presumably certified individuals have a market advantage

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A license is a mandatory requirement that generally allows an individual to perform certain actions if he or she meets specific standards in doing so. Licenses are usually mandatory requirements if the person wishes to perform those actions (e.g., driver's license), and the individual is generally prohibited from performing the actions without a license. For some occupations, moreover, one is not normally allowed to function on that job without a license, e.g., cosmologists.

Certification is usually a voluntary process whereby a professional peer group or organization attests that an individual has attained certain standards in the performance of his or her job. Not being certified does not exclude one from practicing in that profession, but rather deprives that individual of the prestige, and likely the marketability, of a certified status.

In Missouri, professional licensing boards are situated within the Department of Economic Development's Division of Professional Registration. Generally there are representatives from the respective professions (to which the board applies) on each of the boards, and they determine training

requirements, deal with complaints, and so on. One important consideration in any option involving establishing logger licensing is the need for an accurate definition of a logger. For example, someone who only cuts firewood for home use, or fells trees very sporadically for other purposes, would not seem to be the kind of person appropriate for licensing. One way to approach this is to base the definition of a logger on a certain minimum percentage of an individual's annual income being derived from logging.

Within the above landscape, there are a variety of ways in which the question of logger training and licensing may be approached. A voluntary industry-guided logger certification program could be established, with outside (e.g., Missouri Department of Conservation) monitoring of its effectiveness. Funding could come from fees from companies/individuals sending trainees to the program. On the other hand, logger licensing could be made mandatory, with an annual fee requirement for license renewal. In this case, MDC might be responsible for the program, with evaluative input supplied by industry. Moreover, any such mandatory requirements would need to be phased in to allow loggers to become adjusted to the new circumstances. In either of the above cases, continuing education and periodic recertification could be made requirements of the program. Enforcement could be provided through suspension or revocation of the logging license for blatant violations of logging practices. An appeal procedure for loggers should also be included in such a package.

Other variations are possible as well. Thus, for example, a licensing board for loggers could be established, develop standards and certify applicants, with the process itself being either mandatory *or* (in contrast to the norm for licensing) voluntary for loggers. A combination of voluntary industry-guided logger certification and state-administered logger licensing could be adopted. If the certification program were 'worth its salt,' it would presumably exceed the requirements for a state-issued license. Finally, as opposed to regulating the profession *per se* (i.e., the actual practices involved in logging), attention could focus on regulating the use of the *title* (e.g., "Master Logger") associated with the profession.[22]

Any package combining logger training and certification or licensing can only be effective if its existence and potential utility is recognized by the two other major sets of actors involved in the flow of wood from the forest to the mills -- i.e., the forestland owner and the chip mills (or sawmills) themselves. With respect to the former, this highlights the need for encouraging landowners to foster the motivations to hire trained and/or certified loggers when they decide to harvest timber from their

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[22] In Missouri, there are both professional registration boards and title registration boards. For example, the Landscape Architectural Council regulates the use of the title "landscape architect." One *has* to be licensed by the state of Missouri to use that title. So it is possible to have a license that doesn't necessarily regulate a profession *per se* (or any of the practices associated with it), but it regulates the use of the title, such as, for example, "Master Logger" or "certified professional logger."

There could also be a kind of hybrid of this approach. A person would have the choice of becoming regulated if he or she wanted to use a particular title and show that the state had placed its stamp of approval on that person's practice, given that they had, for example, passed an examination. But it would be voluntary. That is, one could still practice logging as his/her primary means of income without having to get registered. That person just could not use the title.

lands. The wide variety of mechanisms described in previous sections relating to landowner incentives to adopt best management practices are relevant here (e.g., educational/assistance efforts, fiscal and tax incentives, regulatory mechanisms, etc.), since hiring competent loggers *is* the primary means the landowner has to accomplish this goal. Thus, for example, forestland owners could be given a tax credit for hiring certified loggers, or doing so could be required if that avenue were decided to be taken.

What could the chip mills (and other mills) offer in this regard? Industry cannot get together and collectively prohibit a group of people from bringing wood to the mills, due to anti-trust considerations. A given company *can*, however, declare that it will only purchase wood from, for example, certified loggers. As reported in the Arkansas study referred to earlier (Gulden 1999), several of the chip mills in Arkansas have refused to buy, or have given their loggers a sundown provision stating that after a certain point in time they will refuse to accept wood from logging operations, unless their loggers had been through the Arkansas Timber Purchasers Association's certified logger training course, which is primarily a BMP education. Thus in terms of the chip mills, any individual mill *can* insist that all contractors and those who bring gatewood to their facility have to be trained professionals. For the mills to do this voluntarily would preclude the alternative option of mandating that a certain percentage of wood brought to the mill have been harvested by trained loggers. It is to be hoped that the mills do indeed assume such a responsibility as part of their role as corporate citizens.

Forester Expertise and Certification

It has frequently been noted that most private forestland owners in Missouri are not receiving advice from professional foresters or land managers when it comes to harvesting timber on their land. Although not conclusively verified, it is widely accepted that less than 10% of owners are receiving any form of professional assistance, either in developing management plans for their forests or in conducting specific harvests.

Potential remedies to this problem mirror those described at the end of the preceding subsection when considering how to encourage landowners to employ licensed loggers. In effect, the two questions are closely linked, along with the need for landowners to ensure the use of best management practices in harvesting timber from their lands. For presumably a certified forester, in proving advice to a landowner harvesting timber, would seek to employ licensed loggers who, having been trained appropriately, would use BMPs when conducting timber operations. Thus the same array of educational and technical assistance strategies, incentives, and/or regulatory means relevant to encouraging landowners to use BMPs, or to hire licensed loggers, would merit consideration as potential ways to encourage landowners to employ a professional forester when harvesting timber form their lands.

At the same time, when forestland owners do seek the services of a 'professional' forester, the questions remains as to how they know they are getting someone who is qualified to provide the

services they expect. Like most people, they may seek advice from friends about whom to recruit; or they might check in the yellow pages, and so on. For many professions, that assurance comes from a state or association credentialing program in which standards for the profession have been defined.

A few facts in addition to those discussed in relation to logger licensing/certification merit attention when considering credentialing for professional foresters.[23] In Missouri, professional registration covers a variety of professions including architects, cosmetologists, embalmers, geologists, interpreters, surveyors, and so on. A variety of factors may stimulate the state licensing or registration of a profession, including the desire of members to set standards for their practices and conduct, the perceived advantages that certification would give the profession in terms of public visibility, and as a means of excluding those who claim to be members of the profession but who have not met its specified standards. In Missouri, a particular profession that has a credentialing program may or may not issue sanctions for practicing without a licence (or certification). Some professions have fairly stiff penalties, while others have none.

Forester credentialing programs exist in seventeen states and have been proposed in several others. All are called either 'licensing' or 'registration' programs, with only one referred to as 'certification.' Although they vary widely, most contain a mix of the following elements :

- Impetus for participation : mandatory or voluntary
- Minimum education requirement
- Years of experience required
- Examination requirement
- Required hours of continuing education
- Fee structure and period for re-registration or renewal of license.

Ten of the sixteen state credentialing programs for foresters that are now in effect are mandatory in nature, meaning that anyone offering forestry services to the public must be registered or licensed. Six states have voluntary credentialing programs. Most of the latter, however, do require licensing or registration for use of the *title* of registered or licensed forester. In North Carolina, moreover, registration is mandatory for consulting foresters, but voluntary for others.

Almost all states require that applicants have attained a B.S. in Forestry. Some states allow experience to be substituted for part of the educational requirement. On an overall basis, most states require a minimum of two to three years of forestry experience in addition to the B.S. degree. In ten states, the applicant must pass a written or oral examination; and ten states have a continuing education requirement as well. The fee structure for forestry credentialing programs varies considerably. Arkansas has the lowest combined fee structure ($7.50 application; $15 annual). California has the highest fee structure ($200 application; $95 annual). In most states annual fees range between $20 and $40; and license renewal periods range from one to two years, although they may be as long as four years.

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[23] The primary source of information for this discussion of forester credentialing is French (1999).

The Society of American Foresters (SAF) supports the establishment of the above kinds of state programs to provide credentialing for the forestry profession. The society also has developed its own program for credentialing of foresters. The SAF Certified Forester Program was initiated in 1994 as a means of identifying foresters who meet certain educational and experiential requirements (Bourgeois 1999). Certified foresters must have earned a B.S. from an SAF-accredited curriculum or a substantially equivalent degree from a non-SAF accredited curriculum. The curriculum must demonstrate a balance among four areas of study : forest ecology and biology; measurements of forest resources; management of forest resources; and forest resource policy and administration. In addition, five years qualifying professional forestry-related experience is required; and certified foresters must agree to complete sixty hours of continuing education every three years. Although the program meets or exceeds requirements of many of the state programs, at present it does not contain an examination component. The latter is currently under consideration for inclusion, possibly as a national test with a regionally specific subsection. The fees for the Certified Forester Program include an application fee of $75, an annual fee of $15, and a recertification fee (every three years) of $50. Finally, the program is voluntary and open both to SAF members and to non-members. The program calls upon its members to abide by current program requirements and procedures for recertification, maintain continuing professional development, and conduct all practices in a responsible, professional manner consistent with state and federal regulations governing environmental quality and forest management practices. Currently there are approximately 750 SAF-certified foresters in the United States and Canada.

The Governor's Advisory Committee strongly endorses the establishment of a certification program for professional foresters in Missouri; and also supported the establishment of a licensing board through which the program would be administered. Its task would be to define areas of professional responsibility and to establish standards and guidelines for applicants. Board members would likely include the Missouri Society of American Foresters (MOSAF), the Missouri Consulting Foresters Association, the Missouri Forest Products Association (MFPA), and the Missouri Department of Conservation (MDC).

In summary, the credentialing of professional foresters has widespread support within the forestry community in Missouri. The professional forester benefits by the assurance that individuals with inadequate training or skills are not representing themselves to prospective clients as possessing the credentials of a qualified forester. The public benefits from the assurance that in securing the services of a licensed, registered, or certified forester, that individual has met the state's or profession's standards for experience, education, and is continuing to do so. The overall result can only enhance the possibility of achieving long-term sustainability of Missouri forests.

F. LANDOWNER RIGHTS & RESPONSIBILITIES

As with virtually all matters of public policy, the possibility of actions that will effectively enhance sustainably managed forests in Missouri rests upon the need to reconcile the personal motivations and objectives of private forestland owners with the interests of the public. Landowners manage their forests for a wide array of purposes. The public also has objectives related to sustaining forests and other natural resources for the good of society, among which is the goal of protecting the public from adverse effects of improper land use practices. This latter goal is most commonly expressed through the enactment of environmental laws and other property-related regulations. In this light, there is an inherent tension between landowners who use the natural resources they own and the public who may want to preserve certain resources on private property as part of a larger societal heritage.[24]

This tension is as old as the country itself. Ownership and use of private property have been essential components of America's society and economy since colonial times. At the same time, colonial courts also enforced the English Common Law concept of nuisance -- an unreasonable interference in the use and enjoyment of an interest in land -- a concept still enforced today (National Research Council 1998). Nuisance laws reflect the fact that property rights have always been subject to the power of the courts to limit uses to protect the interests of other landowners. All citizens enjoy both the freedom and potential of private property and the benefits of government programs. The issue is how to *balance* the property rights of individuals and protect the health, safety, and welfare of the public.

In a real sense, therefore, this question extends well beyond the 'chip mill issue' in Missouri. It does surface as part of that issue, since it underlies all of the subjects discussed thus far in its thematic background (see figure in the introduction to Section II). This relationship between individual goals and the public interest is linked to the fundamental question of freedom of choice for individuals in a democratic society. It is also manifest in the current discussions about property rights in the United States. With respect to the individual, a central tenet in this country's political heritage has always been to protect freedom of choice : the question concerns how we define and interpret freedom.

The critical need for a balance between private property rights and state imposition of responsibilities on the use of private property is a reflection of the fact that important public goals for Missouri's forest resources often cannot be achieved without affecting the actions of private forestland owners and placing responsibilities on how they manage and use their property. It also touches on matters embedded in the U.S. Constitution, because of the Fifth Amendment prohibition against taking private property for public use without compensation. For the individual forestland owner, this balance between property rights and societal expectations is experienced as a personal balance between rights

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[24] This section draws heavily from a much longer discussion of these questions by the National Research Council (1998).

and responsibilities.

Two perspectives of this balance of landowner rights and responsibilities may be found in Table 19. One was formulated by the National Research Council's (NRC) Committee on the Prospects & Opportunities for Sustainable Management of America's Nonfederal Forests. The other embodies the perspective of the National Woodland Owner's Association. The NRC highlights the rights of forest and other landowners to access their property and exclude others; as well as the freedom of choice to define their goals for managing their lands, make economic use of those lands, sell them freely, and enjoy their property without excessive outside interference. In return, landowners have social responsibilities that include paying taxes, complying with land use and environmental laws, and taking into account how their land use decisions will affect their neighbors, surrounding communities, and the broader general public.

The National Woodland Owners Association frames many of the topics discussed in this report in the context of landowner rights and responsibilities. The Association recognizes the importance of environmental sustainability by pledging to show concern for nontimber resources such as wildlife, soil and water, and natural beauty. It pledges to use certified loggers and ensure that best management practices are employed when harvesting timber from member lands. In return, the group expects fair taxes and respect for private property rights, the availability of professional forestry advice and educational opportunities, and that loggers live up to professional standards for timber harvesting and mill owners assume social responsibility, accompanied by self-monitoring, to ensure they do not create markets that encourage improperly harvested wood.

Property rights have never been unlimited. They have always been subject to judicial limits imposed to limit uses to protect the interests of other landowners, which is the basis of nuisance law. On a broader scale, property rights have always been subject to the power of government to enact reasonable restrictions designed to protect the public health, safety, and welfare. This is the basis for laws to protect soil, water, and other natural resources from pollution and/or wasteful exploitation. The most common form of societal restrictions placed on landowners through government actions is the variety of regulatory standards that establish responsibilities, such as requiring permits before certain actions or prohibiting some types of conduct (Ellefson et al 1995). In many ways, establishment of these responsibilities for private resource management has been the way society has defined stewardship.

At the same time, it is possible for a level of government to exceed its constitutional authority in obtaining public benefits by confiscating or restricting the use of private property. The purpose of the "taking" clause of the Fifth Amendment is to prohibit the confiscation of private property without just compensation. When property is physically occupied by the public, this clearly constitutes a taking and, therefore, requires owner compensation. The issue is more complicated in situations where land is not physically taken, but the use is restricted or the value is reduced, as is possible with many environmental or land use laws. If a regulation is too restrictive or constraining in that sense, it can be recognized as a taking.

Table 19. Two perspectives on landowner rights and responsibilities. (Source : NRC 1998)

Landowner Rights and Responsibilities: A Range of Elements

One aspect of the discussion about stewardship and the relation to private property concerns the rights and responsibilities of the owners of private property. The following elements are commonly accepted "rights and responsibilities" of property owners:

Rights:
- To control access to the property and exclude or accept public use.
- To make economic use of the property, including harvesting of trees and other natural resources.
- To choose the primary management goals or objectives, including the right to not use resources.
- To use, sell, transfer, or otherwise dispose of the property freely.
- To seek quiet use and enjoyment of property, free from unreasonable interference by others.

Responsibilities:
- To pay applicable taxes on the land and income generated from the use of resources.
- To comply with applicable laws concerning the use and management of resources.
- To comply with applicable environmental laws to protect resources such as soil and water.
- To consider the impact on neighboring landowners, communities, and the public when making significant land-management decisions.

Private Property Responsibility Initiative of the National Woodland Owners Association

In 1994 the National Woodland Owners Association linked private property rights directly with responsible land stewardship through the "Private Property Responsibility Initiative." The heart of the campaign is a 12-point "Woodland Responsibility Code" as follows:

As Woodland Owners We Agree to:
- Follow Best Management Practices when harvesting trees.
- Show, by action, a practical concern for other resources, including water, wildlife, soil, and natural beauty.
- Share our knowledge of good forestry with others and exercise our property rights in a responsible manner.
- Use only "certified loggers" when available.
- When practical, and at our discretion, we will consider opening our land to hunting and other uses by the public, either at a fee or at no cost.
- Manage our woodlands to promote economic and biological benefits.

In Return, We (Woodland Owners) Expect:
- Respect for private property rights.
- Fair timber taxes, at the federal, state, and local levels.
- Self-policing among mill owners so as not to provide a market for stolen or improperly harvested wood.
- Loggers and foresters to perform to the highest standards.
- Multiple sources of professional forestry advice and educational opportunities.
- A fair chance to compete.

Source: National Woodland Owners Association 1995

This latter situation may arise, for example, with respect to laws prohibiting clearcutting or a zoning ordinances preserving forestland (and hence prohibiting its conversion to other uses, e.g., development for housing). Could these be construed as takings of property? Each case is likely to depend on the facts and the nature of the restrictions. Courts consider many factors when deciding a property claim : the nature of the restrictions and whether they promote a legitimate state interest; the impact on the property value and the owner's reasonable expectations to use the property; and the nature of the public benefit that is being protected or the harm that is being prevented by imposing responsibilities on the private landowner (National Research Council 1998). As a general rule, courts will find restrictions valid if they are reasonably related to promoting a public interest and the landowner is left with some economically viable use of the property. With respect to the use of *zoning* as a collective practice utilized to try and add some order to what is frequently a random process of land-use change, a similar logic is usually applied. If a particular governmental body determines that zoning a tract of land a certain way is an appropriate course of action, then the courts generally do not attempt to second guess what that governmental body decides; unless there appears to be no reasonable basis for that body's decision.

Defining how far a law or regulation can go in restricting the use of private property before it is considered a taking has always presented formidable challenges for legal interpretation. Even the U.S. Supreme Court has commented on its own inability to develop a set formula for determining when economic injuries from public actions must be compensated.

In discussions of the 'chip mill issue' by the Governor's Advisory Committee, the question of respect for private property rights invariably surfaced (at least implicitly) whenever the possibility of instituting any kind of regulatory measure affecting the actions of private forestland owners was raised. As noted earlier, the Committee frequently expressed its desire to emphasize the use of education and technical assistance approaches and positive incentives -- e.g., fiscal measures such as cost-sharing, tax credits, etc. -- as tools to influence landowner behavior towards their forests; in preference to regulatory mechanisms[25] that invariably impose restrictions of some kind on landowner actions. The regulatory option in turn invariably surfaces in response to the question " What if the positive incentives and related approaches don't work, either because landowners are not sufficiently motivated by them or there is simply not enough financial resources available to fund an effective educational and/or incentive program?" When the regulatory option is then raised, the above kinds of questions related to property are often concurrently raised as well (explicitly or implicitly). Frequently discussions reach an impasse at that point, and this tended to be the case throughout the series of meetings held by the Committee

An important lesson from the above is that *any* discussion about government approaches to implementing policies related to natural resource and the environment -- whether it pertains to maintaining ecosystem integrity, soil conservation, protecting water quality, or sustainable forest management -- inevitably raises a concurrent discussion about the implications of the proposed

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[25] It is important to note that a regulation *is* a kind of incentive, frequently to avoid certain actions, and that *avoiding* a certain action is itself a type of action on the part of the individual.

approaches on property rights. This will be as true of future discussions on chip mills and other natural resource issues in Missouri -- which will surely be both stimulated by this report and arise in the natural course of future events -- as it has been during the discussions of the Governor's Advisory Committee. The potential benefit to be gained from this experience, if we wish to avoid spinning the same wheel again the next time such discussions arise, is that of recognizing the logic and dynamic through which the above pattern of discussion seems inevitably to arise; make that pattern the explicit focus of future discussions on chip mills and other natural resource issues; and recognize points where positions have to be taken or choices made, all the while respecting the diverse viewpoints of individuals and groups reflecting different interests in the status and management of Missouri forests.

The above exemplifies a more general lesson to be learned from the pattern of discussion that emerged in Committee debates involving private property rights and societal expectations for responsible forestland stewardship. As the National Research Council (1998) concludes :

> Private landowners most certainly have a responsibility to be good stewards of the land, while society has a responsibility to encourage them to fully exercise these responsibilities. In both situations, the nexus of the issue often involves agreement on acceptable standards of stewardship.....
>
> Discussion of property rights in a forestry context has been valuable because it provides the opportunity for officials and policymakers to consider alternative methods that might be available to achieve the same goals. Conversely, increased attention to property rights concerns can also have negative consequences if it results in the refusal of public officials to act. When that happens the controversy over property rights might result in the delay of important societal objectives because of potential litigation or adverse legislative action.

In light of all of the above, the Governor's Advisory Committee expresses strong support for respecting the property rights of private forestland owners, while calling on them to exercise the responsibilities inherent in those rights. In this light, the Committee also interprets the notion of 'freedom of choice' as follows. Recognizing that no freedom is absolute, and that all rights entail social responsibilities with them, the Committee encourages creating an environment for choices towards enhancing the long-term sustainability of Missouri forests in which forestland owners and others will make the right choices voluntarily on the basis of knowledge of the value of their lands for a variety of economic ends and ecological functions, without having to feel imposed upon by society to do so. This recognizes that government has a moral obligation both to respect individual rights and to protect societal resources; and that landowners have a similar obligation in pursuing their individual interests to engage in responsible stewardship of their lands as valuable assets of Missouri's forest landscape.

G. A RECENT STUDY OF CHIP MILLS IN MISSOURI

In 1997, the Missouri Department of Conservation (MDC) established an internal chip mill committee to assess the potential impacts on Missouri's natural resources of two new high capacity chips mills locating in Southeast Missouri. The nine member technical committee was comprised of representatives from the Department's Forestry, Fisheries & Wildlife, Natural History, and Outreach & Education Divisions. Committee members were assigned tasks from within their areas of expertise to compile an informational report to be submitted to the agency director for review. The report was to be used to determine how the Department might respond to the chip mill issue and to serve as a basis for further review and recommendations to the Conservation Commission.

The draft internal report was submitted to the Director and Deputy Director of MDC in December, 1998. This was shortly after the Governor had issued Executive Order 98-16 creating the Advisory Committee on Chip Mills. The internal report was tabled based on the logic that "the Governor's Advisory Committee on Chip Mills should take precedence over the Department's internal effort, and that it would be inappropriate to take any further action concerning the 'chip mill issue' until the Advisory Committee had completed its report to the Governor" (MDC 1999c).

In December, 1999, following a request under the Open Record Law, the draft internal report was released to the public and, concurrently, provided to the Governor's Advisory Committee on Chip Mills. On January 20, 2000, the Governor issued Executive Order 00-01, which mandated that the Advisory Committee continue its operation until it had carefully reviewed the MDC Draft Internal Report on the Chip Mill Issue. Such a review was to included one or more public hearings on the report.

A public hearing on the MDC draft internal report was held on March 6, 2000, and written comments on the report were accepted up to that time as well. There was broad consensus both at the public hearing and at the Governor's Advisory Committee meeting in March that the MDC Draft Internal Report was a competent and professional analysis that contained relevant and useful information regarding the chip mill issue. There was also a fair degree of criticism of MDC, however, that the internal report had not been presented to the Governor's Advisory Committee in support of its mandate to gather and assess all relevant information regarding the 'chip mill issue.'

Table 20 contains the conclusions and recommendations presented in the MDC internal *Draft Report on the Chip Mill Issue*. The table also includes a draft agency position statement formulated by the authors. However, since the report was tabled pending future actions by the Governor's Advisory Committee on Chip Mills, the information contained in Table 20 should not be construed as an official statement of policy by the Missouri Department of Conservation or the Missouri Conservation Commission (MDC 1999c). Some of the recommended actions (e.g., topics 1,3,4, and 9) have, however, already been implemented by MDC as separate policy actions.

Table 20. Conclusions and Recommended Actions of the Missouri Department of Conservation's Internal *Draft Report on the Chip Mill Issue* (completed December 1998)

Conclusions

1. Natural resources and the extent and manner of timber harvesting, primarily on private land, constitute the "chip mill issue" in Missouri, not the chip mills themselves.

2. If private forest landowners use voluntary best management practices (BMP's) for timber harvest (Missouri Department of Conservation 1997) and regional annual harvest does not exceed regional annual growth, Missouri's forest resources can support a chip mill industry.

3. Landowner surveys reveal that most private forest owners have never consulted a professional forester, and fewer still have had a forest plan written for their properties. Acknowledging that BMP's are voluntary, there is a potential that any resultant increase in harvesting to support chip mills will result in increased runoff, sediment transport, nutrient leaching, and increased stream temperatures during the first few years following harvest.

4. Without a mechanism to accurately document and track timber harvests, we will remain unaware of the extent to which BMP's are being used on private land, and will lack the ability to monitor any short-term changes in forest resources attributable to the chip mill industry.

5. Age composition of private forests could change from one with a balance of mature and young trees to one with primarily immature trees if landowners meet the chip mill market by harvesting all stock as soon as it's marketable -- in this case, progressively younger stock.

6. Given the lack of landowner support for the state regulation of private forest land, effort should be increased on implementing existing private forest assistance programs and developing new incentive programs to conserve Missouri's forests.

Recommended Actions

1. Adopt (in 1999) an MDC policy (to take effect in 2000) that requires loggers who purchases timber on MDC land to implement and document use of BMP's and make it a prerequisite for the logger to have successfully completed the Professional Timber Harvester (or equivalent) Program. During the next year, work with industry to explain the policy and offer assistance in fulfilling requirements.

2. Encourage policies by timber companies in Missouri to require, track and document the successful use of BMP's on land where wood fiber is purchased, and require that their contract loggers successfully complete the Professional Timber Harvester Program.

3. Request that the Missouri Forest Products Association and other forest interests increase the emphasis placed on BMP's in the Professional Timber harvester program.

4. Commit the funds necessary to double the sampling intensity for the Ozark and River Border units of the Forest Inventory Analysis.

5. Propose an amendment to the State Forestry law that would sunset the Forest Cropland Program and, in its place, create a new, more effective and attractive program to increase landowner participation in appropriate forest management.

6. Develop and propose an amendment to the State Forestry law that would require landowners to notify MDC of pending commercial harvest of 20 acres or more and give MDC foresters the right to inspect. The proposed amendment would create a yield tax that would be distributed back to the landowners for implementation of stewardship plan objectives and best management practices.

7. Create a pilot project that focuses on the overlapping procurement zone for the Mill Spring and Scott City chip mills, where MDC would proactively encourage the development of stewardship plans for cooperating landowners

8. Support research funding to investigate potential water quality concerns and socioeconomic impacts within the souring areas of the Mill Spring and Scott City chip mills.

9. Seek out on-the-ground examples of good forest management practices by private landowners that have utilized the chip mill mill market and use them for demonstration purposes to encourage other private landowners.

Draft Position Statement

Chip mills exist because there is a market for paper products. The environmental impact of forest product industries in Missouri depends on whether best management practices (BMP's) are used during harvest and the total volume of wood harvested. Surveys indicate that most private forest owners do not consult a professional forester. Likely, BMP's are not being employed on the majority of private forest lands. MDC recommends that a coordinated, statewide effort be focused on dramatically increasing the technical assistance and incentive programs which would result in the effective use and monitoring of BMP's on private forest land. To accomplish this task, MDC will participate in the development of an incentive, technical assistance and legislative package to assist private landowners with forest management.

H. CHIP MILL EXPERIENCES IN OTHER STATES

In Missouri, high capacity chip mills had been operating for a short time when concerns about the possible short- and long-term effects of the mills' operations on the viability of Missouri forests began to surface. This, in effect, led to the crystallization of what has been termed the 'chip mill issue' in Missouri. In response to the growing controversy, Governor Mel Carnahan created an Advisory Committee on Chip Mills in November of 1998.

Missouri, however, is not the only state in which chip mills and their potential impacts on the forest resource have been the subject of controversy. In Tennessee, Arkansas, North Carolina and Virginia, concerns about possible environmental effects of chip mills have led to either the creation of a body with functions similar to those of the Governor's Advisory Committee in Missouri; the completion of a full-fledged environmental impact statement; or in the case of Arkansas, research focusing on the possible effects of chip mills on the practices of private forestland owners. In other states, e.g., Alabama, chip mills have comprised one element of broader controversies focused on potential impacts of forest practices in the state, but have not themselves been the focus of the kinds of activities described above.

It is worthwhile, therefore, to review briefly the experiences of other states with the 'chip mill issue.' This may both facilitate placing Missouri's experience in a broader regional context as well as provide an opportunity to learn from how these states have addressed or are approaching the issue. The first part of this section looks briefly at the responses of four southern states to the current and potential impacts of chip mills on their forest resources. Attention then shifts to an example of a *regional* perspective taken by an ongoing study focused not on chip mills *per se*, but on the health of the forest resource in general throughout the region (the Southern United States). Given that the chip mill industry is, however, a major economic actor throughout much of this region, a brief overview of how this study is being conducted may be helpful for future efforts to better understand the issue in Missouri.

Other States' Approaches to the 'Chip Mill Issue'

The following consists of brief descriptions of how the 'chip mill issue' has been or is being addressed in the states of Tennessee, Arkansas, North Carolina, and Virginia. The discussion begins with Tennessee, as it is there that issues directly related to the potential impacts of chip mills on the state's forest resources have been the focus of attention for the longest period of time.

Tennessee. In 1989, the Tennessee Valley Authority (TVA) and the U.S. Army Corps of Engineers (USACE) approved a chip mill barge terminal on the Kentucky Reservoir. Commenting agencies such as the U.S. Environmental Protection Agency (EPA) and the U.S. Fish & Wildlife Service

(USFWS), as well as numerous groups representing environmental and other interests, voiced concerns about the possible effects of timber harvesting patterns that might be stimulated by the terminal. A year later TVA and USACE received chip mill barge terminal applications from four companies (Boise Cascade, Canal Industries, Donghae Pulp, and Parker Towing) seeking to build large terminals for chip mills within a twelve-mile reach of the Tennessee River in Tennessee and Alabama. Two of the applicants subsequently combined their application, leaving three applicants. The agencies initially prepared individual environmental assessments (EAs) for two of the applicants.

Significant opposition to the proposals surfaced in 1991 following public hearing on the Parker Towing and Donghae Pulp applications. Letters were received from the EPA and USFWS requesting that an environmental impact statement (EIS) be prepared. TVA and USACE decided to prepare an EIS, which was to include cumulative effects of locating one or more chip mills within the same forest procurement area. TVA assumed the role of lead agency in compiling the EIS, with USACE and USFWS acting as cooperators. A draft EIS was released in 1992. No preferred alternative was stated, but TVA stated that it was "inclined to deny" the applications and invited those commenting on the EIS to recommend ways to address concerns that had been identified with respect to adverse environmental effects of timber harvesting.

The Final EIS was released by TVA in 1993 (Tennessee Valley Authority et al 1993). TVA's preferred alternative was to deny all requests. In May of that year, TVA published its Record of Decision in the Federal Register, denying all requests associated with the three chip mill applications. The Alabama-Tennessee Forest Resources Limited Partnership, Boise Cascade Corporation, and the American Forest & Paper Association filed suit challenging the permit denials shortly thereafter, alleging that TVA had exceeded its statutory authority when it considered "remote sourcing area impacts which are only tenuously related to the subject of the requests for approval." In 1995, the U.S. District Court for the Northern District of Alabama dismissed the industry lawsuit, stating that TVA did not exceed its authority in denying a permit to Boise Cascade, while also stating that the agency may consider private land impacts when regulating activities on the river.

In justifying its decision, the TVA discussed a number of potential effects on timber harvesting that could be expected to result from locating chip mills in the area under consideration. The EIS noted that an increase in the percentage of harvests classified as clearcuts could be expected as a result of chip mill timber procurements. Compared to the types of harvesting currently occurring in the 42-county source area, clearcutting was expected to jump from 44% to as much as 69% of the harvests if three chip mills were to locate in the region, while selective harvests were projected to decrease from 56% of all harvests to 31%. These figures implied that 114,000 acres per year of the forests would be clearcut, compared to 55,000 acres per year without the mills. The decision noted that clearcutting would favor a wider array of tree species, including commercially valuable species, although actual composition of future stands that regenerate is not always predictable. It was also noted that the net change in the timber resource was expected to be able to support three new mills or any lesser combination (TVA et al. 1993).

The EIS also stated that increased timber harvest in the 42-county area would cause stream changes

in four categories : temperature, sedimentation, flow modification, and nutrient enrichment. It was noted that progressively more extensive habitat disturbance and less effective mitigation of timber harvest impacts would result in increasingly detrimental effects on aquatic habitats. Also cited was the fact that increased timber harvests could result in adverse impacts to endangered and threatened species occurring in the area. The most extensive impacts for aquatic species would be expected for those living in large creeks and small rivers. Species in springs could be expected to be affected, while those living in large rivers would least likely be affected. The U.S. Fish & Wildlife Service did conclude that implementation of either alternative allowing for establishment of a terminal for shipping wood chips would likely jeopardize the continued existence of 16 or 17 endangered and threatened species, depending on the alternative, and would result in the destruction or adverse modification of designated habitat for three species (TVA et al. 1993).

In 1997, these and other concerns -- including a 1996 lawsuit filed by four environmental groups against TVA and USACE alleging violations of the National Environmental Policy Act and Endangered Species Act in permitting docks for log loading along the Tennessee and Cumberland Rivers[26] -- led the Tennessee Legislature to adopt a joint resolution, approved by the Governor as well, establishing the Tennessee Forest Management Advisory Panel. The panel was charged with evaluating and recommending appropriate policies and programs that promoted sustainability of all Tennessee forest lands. Thirty-four representatives were appointed to the Panel, but only 29 actually actively participated in the voting process. Their task was to assess the management and guidelines for state-administered forests; consider policies for forest management practices; evaluate objectives, programs, and services available for private forestland owners; and consider alternative funding strategies to accomplish sustainable forest management in the state.

Beginning in November of 1997, the Panel held eleven monthly two-day meetings. The meetings ranged from educational field trips to facilitated discussions on Tennessee forestry issues. In December of 1998, the Panel issued a final report that contained 28 majority recommendations (and 24 minority recommendations) that resulted from its work (Tennessee Forest Management Advisory Panel 1998). The majority recommendations were grouped within four broad categories : 1) Increasing education; 2) Research; 3) Partnerships; and 4) Promoting incentives. Education actives recommended included enhancing and expanding education in best management practices for landowners and professionals, as well as establishing a registration program for professional foresters. Recommended research foci included implementation of the Southern Annual Forestry Inventory System, assessing the causes of and developing potential actions to reduce forest fragmentation, and enabling the State Forestry Division to incorporate all forest-based fauna and flora within its planning and management efforts for state-administered forestlands. In the area of partnerships, the Panel recommended establishing timely and effective mechanisms for public participation in state forest planning and management, as well as establishing a variety of partnerships between state agencies and nonprofit organizations, forest industry, and other local and federal agencies with the goal of promoting sustainable management of Tennessee forests. Finally, the Panel recommended continued emphasis on providing forestland owners with incentives to practice good forestry; it continued to

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[26] This suit was subsequently dismissed in 1998 for lack of standing.

support BMP compliance through voluntary practices; and it encouraged state agencies to strengthen and enforce disincentives for loggers who violate water quality laws.

In its final set of majority recommendations, the Panel did not specifically address the question of chip mills and their potential economic and environmental impacts on Tennessee's forests and economy. There was, however, some level of disagreement about the chip mills, and a moderate number of panel members expressed concerns about such things as overcutting of the forest resource, negative impacts on water quality, favoring pine plantations over native hardwood species following harvests, and potential decrease in biological diversity. The disagreement over the existence and/or severity of such phenomena was manifest in unusual fashion: it was expressed in two separate and contradictory minority recommendations regarding the need for a statewide study of the potential impacts of chip mills in Tennessee. (A 'minority' recommendation was one which garnered less than fifteen votes from among 29 panel members with active voting status). Fourteen panel members voted for a recommendation that there should *not* be a statewide chip mill impact study; while ten panelists voted for a separate recommendation that there *should* be a statewide chip mill impact study. This is suggestive of the depth of feelings that surrounded the question of chip mills in Tennessee. In terms of the Panel's majority recommendations, the absence of reference to chip mills reflected members' views that there was a lack of empirical evidence demonstrating that chip mills promote native forest replacement with pine plantations or that they are exclusively harmful to the local sawmill industry.

Arkansas. A recent study in Arkansas examined a small segment of a much larger chip mill industry in the state -- hardwood chip export mills (Guldin 1999; Gray and Guldin 1997). Since this study has been cited frequently in the report, it is summarized quite briefly here. It has been of particular interest to the Governor's Advisory Committee, because it is one of the few studies to date that has focused primarily on the impacts of demand for chips on the harvesting practices of landowners who supply timber to meet that demand. In addition, the study focused on *hardwood* chip markets, in contrast to the chipping of softwoods which comprises much of the overall chip market in Arkansas; and in so doing it directly considered the oak-hickory forests characteristic of much of Missouri.

Hardwood chip export mills, which began operating in 1995, represent a very minor segment of the Arkansas wood industry. Hardwoods are chipped and sent in bulk to the Pacific rim, primarily Japan, where chips are used for paper production. Currently chip export mills in Arkansas annually use about 500 thousand tons of wood drawn from a 37-county area, some of which borders Missouri. This represents a 25% increase in hardwood pulpwood production in Arkansas since 1994, a 7% increase in total hardwood harvest, and a 15% increase in total hardwood harvest within the 37-county source area. These increases have led to some controversy in the state about the potential effects of these mills on the long-term sustainability of Arkansas forests.

The Arkansas study looked at a number of questions similar to those addressed by the Governor's Advisory Committee in the context of Missouri forests. The contribution of the hardwood chip export mills to the Arkansas economy was found to be relatively small, but this was not entirely unexpected due to the small size of this industry segment. The study concluded that the new market created by the export chip mills was not likely to drive small sawmills out of business, given the

structure and volatility of this segment of the industry over the past decade. The authors were unable to determine whether harvesting to supply export chip mills would hurt the tourism in Arkansas, noting that site specific locations of harvests may have as much to do with tourism impacts as regional trends. As to the question of whether soil and water resources would be protected in the wake of harvesting patterns to meet chip demands, the authors believed that the jury was still out in terms of a definitive answer. While noting that harvests were occurring without the use of BMPs in some cases, they believed that the chip mills were convinced that use of BMPs was important.

The study also concluded that harvesting for chip export mills was not likely to lead to a major loss of hardwood forests in Arkansas; slightly less than a 2% reduction in supply was forecast to occur in the 37-county source area. In addressing the broader question of whether there was any danger of running out of hardwood timber in the state (or equivalently, enter a situation in which removals exceeded growth), the authors did not see this as likely to happen given current market demand. They did note, however, that if one or more additional chip mills were to enter the picture in Arkansas, removals would likely exceed growth by as soon as the year 2005.

Among the more interesting findings of the study pertained to the kind of hardwood markets actually created by the chip export mills, and the practices used by private forestland owners in supplying timber to meet mill demands. It was concluded that the chip export mills created a market that falls short of what would be considered ideal for hardwood timber. Hickory is not taken, although the mills do provide a market for rough and rotten trees. Moreover, the segment of the ideal market that would provide the greatest potential for using sound forest management practices to improve the quality of Arkansas hardwood stands -- i.e., the removal of pulpwood and tops from sawtimber thinnings, as well as other hardwood-pulpwood thinnings -- did not appear to be developing in response to demands for wood by the mills. A major reason for the above was revealed in the kinds of practices being used by landowners in responding to timber demands from the mills. It was found that more than nine-tenths of all harvests involved removal of all trees from the site and either : a) simply letting the stand grow back naturally, with no guidance from management; or b) converting what had been forestland to pasture or some other non-forest use. The authors concluded, therefore, that the kind of harvesting that was occurring to supply wood for chip export mills in Arkansas was, for the most part, not good forestry.

North Carolina. In 1996, Governor James Hunt received a report of the Governor's Task Force on Forest Sustainability. In response to concerns about increased logging pressure on the state's forests, the following year the Governor ordered the state Department of Environment and Natural Resources (DENR) to report on technical issues relating to chip mills. In 1998, the DENR awarded $250,000 in funding for a study to the Southern Center for Sustainable Forests, a cooperative center among Duke University, North Carolina State University, and the DENR Division of Forest Resources. The study began in May of 1998 and a final report was expected in June 2000.

The purpose of the study is to evaluate the ecological and economic effects associated with current and future wood chip production in North Carolina. The principal questions being addressed by the study concern whether expansion of chip mill technology in the state will result in: a) changes in

competition for materials among forest product sectors; b) land use incompatibilities between forest products and tourism sectors; and c) undesirable long-run ecological consequences. An overview of the major components of the study may be found in Table 21.

The two central components of the study involve an economic assessment and an ecological assessment. Each component is relying on a mix of on-site surveys, literature reviews, and modeling techniques to examine the impacts of chip mills in the state. The principal foci of the economic assessment include: a) current status of the forest resource; b) forest products industry trends; c) timber and tourism tradeoffs; d) local community impacts; and e) nonmarket values.

Table 21. Economic and Ecological Components of the North Carolina Wood Chip Study (Source : Southern Center for Sustainable Forests 1998)

Economic Components

(1) Impacts of wood chip production on timber supply
(2) Effect of wood chip production on wood-based manufacturing firms
(3) Effects of improved timber markets for forest landowners
(4) Market and nonmarket impacts on economically efficient forest management practices and forest conditions
(5) Impacts of wood chip production on local economies, infrastructure, and communities.

Ecological Components

(1) How wood chip production alters ecology of forest management practices in North Carolina
(2) Direct, indirect, and cumulative effects of wood chip production on forest structure, plant and animal communities, soil erosion and fertility, and water quality
(3) Impacts of wood chip mills on stormwater and wastewater runoff from processing facilities
(4) Evaluation of forest management options for assuring sustainability of North Carolina's forest resources as harvest pressures continue to mount, and as forest values continue to increase.

In assessing the current status of forests in North Carolina, attention is focusing on area, inventory (volume and species), timber growth and removals (stocks) and timber availability (supply) as related to net growth and landowner objectives. An important related focus is the relationship between forestland ownership and timber availability. About three-fourths of the forest lands in North Carolina are controlled by some 700,000 nonindustrial private forestland owners, and another 12% of the state's forests are owned by forest industry. Chip mill issues related to private forestland owners that are being addressed in the study include revenue opportunities, stand improvement opportunities, and changes in procurement strategies.

A second focus of the economic component of the study is concerned with identifying the structure of and trends in the state's forest products industry. Topics being considered include changes in technology and materials merchandising, and purchaser trends, both domestic and foreign. A major point of interest is the relationship of such trends to the demand for chip mill products.

In investigating current and potential tradeoffs off timber versus tourism, the study is focusing upon effects on state and county revenues, infrastructure, and amenities associated with forest lands. The analysis is spatially explicit, based on demarcations of areas of intensive recreational use, areas or substantial timber procurement, and geographical overlaps between the two. Local community impacts are being analyzed in terms of state and local policies, infrastructure (especially roads and traffic), health and safety, and community opinions on such things as noise and aesthetics. Finally, nonmarket values are being addressed through efforts to identify positive and negative off-site environmental effects of timber harvesting. Foci here include water quality and quantity, wildlife values (game and nongame), forest structure, and amenity values.

A variety of available models and data sets are being utilized in the study. The primary timber data is from the 1990 forest inventory and analysis (FIA). Timber products output updates are also being used. Available industry data and tax revenue data constitute other relevant sources of information. Inventory projections are being accomplished with the aid of a subregional timber supply (STRS) projection methodology. Regional economic and social impacts for timber and tourism industries, and tradeoffs between them, are being analyzed with the aid of a regional input-out model (IMPLAN) employed by the U.S. Forest Service. The study is applying financial models to assess impacts for forest landowners in terms of economic benefits and costs of alternative timber harvesting projection scenarios, as well as impacts of potential strategies for forest management available to owners.

The ecological assessment -- the second primary component of the overall study -- is addressing three basic areas : a) the historical context of forest lands in the state, with ample recognition given to North Carolina's agricultural legacy; b) stand level effects related to timber harvest, including regeneration, water quality and wildlife effects; and c) cumulative effects.

At the stand level, the study is investigating the potential impacts of chip mill harvesting on such variables as biomass removal; changes in average rotational age; and water quality, with emphasis on temperature, sediment, and the generation and impacts of nonpoint source pollution from timber harvesting practices; as well as the effects such practices on site productivity. The status of wildilfe in terms of game species, nongame species, and threatened and endangered species is also an important concern at the stand level. Aquatics and storm water runoff are two additional ecological foci of the study. Finally, cumulative ecological effects are being assessed in terms of aggregate measures of water quality, landscape fragmentation, and the connectivity of genetic resources, e.g., corridor analysis.

Just as with the economic component, the ecological assessment component of the study relies on a variety of methods. In addition to the use of prior published research and the collection of field data, the assessment is employing computerized wildlife distribution models and landscape ecology

models. A major emphasis of these approaches is to allow analysis of the chip mills as they are situated within, and by their actions affect, a landscape context. In this way the impact of the mills may be more directly linked to such phenomena as shifting patterns of timber harvesting, land use, and population density.

In summary, achieving the overall objective of the North Carolina Wood Chip Study depends upon the integration of economic and ecological components. The intent is to conduct an integrated analysis at both small scale (stand, local community) and large scale (state, region, landscape) levels, and to seek to uncover linkages between the two. The investigators believe that this is the most realistic and effective way to assess the long term impacts of chip mills and associated harvesting patterns on both the people and the forest resources of North Carolina.

A number of individual elements within the overall Study have been completed, including a historical background of North Carolina forests (Burleson and Cubbage 1999); most of the research on the regional economic impacts of timber and tourism in the state; estimates of impacts of increased timber harvests and prices on market returns received by private forestland owners; and the social and community impact analysis field work. The entire North Carolina Wood Chip Study is slated for completion in June of 2000.

Virginia. A process has recently been initiated in the state of Virginia that perhaps more closely resembles the history of the Governor's Advisory Committee in Missouri than do the other three chronologies described thus far. In July of 1999, the Virginia Legislature established a Chip Mill Study Committee to investigate the potential economic and environmental impacts of satellite chip mills in Virginia. A satellite mill is one which is directly associated with a manufacturing plant. There are currently four such mills operating in Virginia, and as with the chip export market in Arkansas, they comprise a relatively small sector of the state's chip industry.

The Committee is made up of fifteen members, including six state legislators, the state Forester, representatives of the solid wood and chip industries, and representative of three environmental organizations. In contrast to Missouri and North Carolina, the primary impetus for this process originated with the state legislature, as opposed to the governor of the state. The Governor of Virginia has, however, endorsed the function of the Chip Mill Study Committee. The legislature allocated $12 thousand to help the Committee conduct its activities, which will extend over a period of two years.

After its formation in July 1999, the Committee held four meetings over the remaining part of the year. The first was primarily informational in nature and included five presentations. The Department of Forestry informed the Committee about its overall mission and activities in the state; a private forestland owner discussed the importance of forest industry to people like himself; and three representatives of environmental groups voiced their concerns about a variety of potential effects that might result from the operations of satellite chip mills in the state. At the second meeting, five additional perspectives were presented to the group. It received overviews of the North Carolina Study and the Southeast Forest Resource Assessment Project currently underway, and a summary

of forest industry trends in Virginia from 1940 to 1992. Economists representing both forest industry and environmental groups also spoke to the Committee regarding their views of what constitutes resource sustainability.

The Committee has met twice thus far in the year 2000. The May meeting consisted of a field trip in which the group visited a chip mill, as well as a forest landowner who was disconcerted with the effects of the chip mills in her area. Overall they were positively impressed with efforts of the industry to respond to the landowner's concerns. They also visited a tree farm in the same area, owned by a landowner who was participating in Westvaco Corporation's private forest management program. There they were able to get a feel for the perspective of a private landowner who was actively interested in growing timber on his land.

At this stage of the process, the Committee is struggling to better define the issue and establish the parameters of the debate. In general, the Chip Mill Study Committee in Virginia is going through many of the same kinds of "growing" or "identity pains" experienced by the Governor's Advisory Committee in Missouri as it worked through its task; and time will tell how successfully it addresses the difficult challenges ahead.

The Southern Forest Resource Assessment

In addition to groups and/or studies which have focused on the 'chip mill issue' within individual states, another noteworthy study is currently taking a regional perspective in analyzing the status and integrity of forest resources over a multi-state area. While the focus of this study is not on chip mills *per se*, the latter are certainly an important part of the industrial landscape in the study region. Thus it is worthwhile to briefly consider this effort along with those described above.

In May, 1999, a collaborative effort involving several government agencies and a wide variety of public interest groups was initiated to examine the status, trends and potential future of southern forests and their various benefits. The Southern Forest Resource Assessment (SFRA) is an effort being led by the USDA Forest Service in cooperation with the U.S. Fish & Wildlife Service, the Environmental Protection Agency, the Tennessee Valley Authority, and southern states represented by state forestry and other natural resource agencies. The study area traverses the Southeast. It includes forests in Alabama, Georgia, Arkansas, Kentucky, Florida, Louisiana, Mississippi, North Carolina, South Carolina, Virginia, Tennessee, Texas and Oklahoma.

As timber harvesting has declined in other regions, the South's timber harvests have increased and now dominate U.S. production. Increased harvests, along with changes in the location of wood-using facilities and the technologies used to process wood have raised public concerns. With a general southward shift of commerce in the United States, the region has also experienced rapid population growth, economic expansion, and urbanization. Human activities in the South and around the world have also led to changes in environmental and ecological systems and resulting changes in climate, insect, and disease stressors that can reshape forest structure and function. The Southern Assessment

intends to investigate all of these changes and their implications for forests and the multiple values that they yield.

The SFRA is a question-driven assessment. Twenty-two questions have been developed through extensive public scoping and internal and external review. Twenty-five analysts and researchers from state and federal agencies now comprise the Assessment Team and are beginning to compile data to answer these questions. In addition to this broad scale assessment, they effort will also identify areas where changes are concentrated. In those areas small scale assessments on a finer scale will be conducted. In terms of substance, the broad assessment is divided into five categories or dimensions of sustainability : landscape and terrestrial ecosystems; water/aquatic ecosystems; forest extent/structure/health; timber markets/forest management; and social/economic factors. Each category is further subdivided according to a number of topics. Thus, for example, the landscape and terrestrial ecosystems category includes the topic areas of forest and habitat fragmentation; game and non-game animals; plant species; threatened & endangered species; tree species composition; and habitat distribution.

The broad-scale assessment has been designed to proceed through four phases : a) Definition of assessment questions (May 1999 -- February 2000); b) Development of work plans (February -- March 2000); c) Technical analysis (March -- December 2000); and d) Synthesis and reporting (January -- July 2001). As of May, 2000, the Assessment had proceeded through the development of questions and work plans to address each of the broad questions, and had entered the analysis phase. The Southern Forest Resource Assessment has a web site that may be found at www.srs.fs.fed.us/sustain .

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The capsule overviews presented above involve different states with differing forestland resources; different mechanisms to address the 'chip mill issue' (e.g., a deliberative body vs. a research project); and different levels of financial resources with which to work. They do, however, along with the Governor's Advisory Committee in Missouri, embody a common purpose : they are expressions of a public commitment to ensure the long-term sustainability of both the forestlands that are a vital part of these states' natural heritage and the economic and social livelihoods of the people who depend on those forests for a living and/or simply value them for what they are. The extent to which any or all of these efforts are successful will ultimately depend on the willingness of all involved to recognize these processes as opportunities for learning and enhanced understanding, not only of the forested landscapes in which they live, but also of themselves as citizens of communities defined by both forests and people.

III. ACTION AREAS

The subjects discussed within the Thematic Background form the basis for the recommendations which follow with respect to the issues raised by the arrival of high-capacity chip mills in Missouri. The Governor's Advisory Committee on Chip Mills regards these subjects as critical ingredients to the long-term sustainability of Missouri's forests and to the economic, social and cultural well-being of its citizens. In structuring this section on potential actions, policies and programs, several of the subjects discussed in Part II -- Sustainable Timberland Resource Base, Sustainably Managed Forests, and Landowner Rights & Responsibilities -- are not addressed as separate decision areas here. Rather, they are considered as elements within three central thematic subjects towards which committee actions may be directed: Environmental Sustainability; Education, Training, and Professional Management; and Economic and Social Impacts. Moreover, since policy choices are invariably influenced by questions of funding and financial viability, a fourth topic -- Financial Support -- has been added to the above . The committee discussed a wide range of action, policy, and program options under each of these four themes. The recommendations supported by a *majority of the committee* are presented here. For those interested in all of the recommendations that were considered and the roll call vote on each, these may be found in Appendix C.

Outline of Section

I. Environmental Sustainability

II. Education, Training and Professional Management

III. Sustainable Economic and Social Impacts

IV. Financial Support

1. ENVIRONMENTAL SUSTAINABILITY

The Committee agrees that sustainability of all forest resources is critical and can be influenced for better or worse by the kinds of practices conducted on forest lands in the state. This inherently involves sustaining the unique geological underpinning and rich heritage of biodiversity of Missouri forests. A sustainable environment encompasses both the living and non-living elements of forest ecosystems. The living components include diverse and viable wildlife populations, trees of mixed species and ages, and contiguous blocks of forested landscapes. Sustaining such an environment also requires minimizing soil loss, ensuring the integrity of watersheds, and safeguarding clear streams and springs.

The Committee supports education and training in sustainable forest management for landowners and all segments of the forest products industry. A corollary of the above is that when managing for timber production, all harvests should be conducted in a way that minimizes soil loss and deterioration of water quality. This lends credence to the goal of having loggers trained in best management practices and landowners educated in sustainable forest management.

In the Thematic Background, it was frequently noted that the impacts of high capacity chip mills on the environmental sustainability of Missouri's natural landscape will be manifest in the kinds of harvesting practices forestland owners adopt in supplying timber to the mills. The Committee considered a number of areas in which possible outcomes of this process would likely have implications for environmental sustainability.

Recommendations

Sustainable Forest Resources Act and Forest Resources Council

- Update State Forestry Law to include new incentives intended to increase participation in the program and ensure long-term forest resource sustainability for Missouri. Best Management Practices shall be utilized as a general requirement for any forest landowner receiving assistance under such program.

- A Forest Resource Council should be established. The Council would serve at least four roles:
  1. Foster collaboration and provide an ongoing public forum among landowners, loggers, wood-based industries, environmental interests, the tourism industry, public agencies and others with a vital vested interest in the well-being of Missouri's forest resource.
  2. Advise the governor and state, county and local governments on sustainable forest resource policies and practices.

3. Coordinate priority forestry research efforts in the state and develop and implement initiatives in sustainable forest management.
4. Appointments shall be submitted by the groups involved and confirmed by the Senate, assigned to the Department of Conservation for administrative support.

Ensuring Best Management Practices (BMPs)

- An interagency task force of the Departments of Conservation, Natural Resources and Agriculture; a representative of industry, an environmental organization, and professional forestry organization; and the School of Forestry and Natural Resources, University of Missouri, should be created to evaluate the present definition of "Best Management Practices" by January 1, 2002.

- It is the interest of the state of Missouri that owners of forest lands use Best Management Practices (BMP) based on "Missouri Watershed Protection Practices" published by the Missouri Department of Conservation with Missouri's Department of Natural Resources and other agencies, to protect soil and water resources for current and future generations of Missourians.

  It is the purpose of this action to ensure that BMPs will be carried out within the sensitive portions of riparian areas and where the forest cover is to be greatly reduced on sizable areas of land to protect water quality, especially in the karst topography of the Ozark Region where soils are inherently low in fertility and the landscape is more dissected.

  The use of best management practices is voluntary except when a landowner, trustee, timber deed holder or assignee plans to remove 50% or more of the forest cover (measured by trees 5.0 inches in diameter at breast height, 4.5 feet in height) on more than 40 contiguous acres of forest land within one year within the Ozark Regions.

  A Missouri Timber Harvest Permit must be obtained in advance for those situations where BMPs are required under the above paragraph. Permits would be issued by the Missouri Department of Conservation. The issued permit grants access to the Department for the sole purpose of inspecting the permitted area(s).

Information Base

- Develop a database about forest resources in Missouri similar to what is presently done for agriculture in the Census of Agriculture. The database needs to include:
  1. Forest land ownership
  2. An annual inventory and survey of forest resources and use.

- The General Assembly should fund :

  1. A long term research effort, focused on the chip mill sourcing zones and utilizing remote sensing, to investigate harvest site, location, methodology and use of Best Management Practices. The long-term research effort should consider :
     a. An annual inventory intensive enough to detect resource changes in a short time period.
     b. Can technology detect changes in size class distribution?
     c. Can remote sensing be used to help determine the impacts of forest fragmentation?

  2. A comprehensive two-year scientific study of the environmental, social, and economic impacts associated with chip mills, including harvesting in the southeast Missouri sourcing areas, to be led by the University of Missouri College of Agriculture, Food and Natural Resources; and to include members from the Department of Conservation, Department of Natural Resources, Department of Economic Development, Department of Agriculture, Natural Resource Conservation Service, USDA Forest Service–Research, and Environmental Protection Agency; and to be submitted to the General Assembly no later than January 1, 2003.

  [The above reflects the original recommendation (4/9-10/00) as amended on 7/31/00.]

- The Committee supports a system of voluntary harvest pre-notification to the Missouri Department of Conservation of commercial timber harvests as a means to disseminate forest management information to landowners and to aid in the collection of information on extent and type of timber harvests, type of forest management used, and the use of Best Management Practices on timber harvests on private land.

- Legislation should be passed to establish authority for determining the characteristics of the timber used by high capacity chip mills.

Other

- Companies should be encouraged to use the principles of the Sustainable Forest Initiative (SFI) or other certification programs on all forestlands and participate in a verification process.

- Responsible parties should be fined based on the environmental degradation their actions have caused. The resulting fund would then be used for a combination of education, incentives, regulation and monitoring.

2. EDUCATION, TRAINING AND PROFESSIONAL MANAGEMENT

The Committee strongly agreed that education, training and professional management is critical to the long-term sustainability of Missouri forests. The Committee would like to have every forest land owner and mill operator educated in sustainable forest management, all timber harvests conducted in accord with best management practices (BMPs), and all loggers professionally trained. This in turn may contribute to enhanced public understanding of and respect for Missouri's forests and their management.

Recommendations

Logger Training

- Support the existing Statewide Certification Training Program for Loggers and create incentives for voluntary logger certification and encourage the use of such trained loggers in timber harvesting and maintain a list of such certified loggers.

- Encourage the formation of a coalition of forest landowners that would agree to use only trained loggers and implement sustainable forestry principles.

Professional Foresters

- Establish a Professional Registry Board for professional licensed foresters to practice in Missouri.

Landowner Education

- Conduct a comprehensive evaluation of all existing forest landowner education programs in Missouri.

- The University of Missouri Outreach and Extension in conjunction with MDC foresters offer silviculture courses throughout the state in an intensive educational drive for five years.

- Expand the Forest Cropland or Stewardship programs already in place and aggressively market them to enroll landowners in the programs.

- Establish working group of the Departments of Agriculture, Conservation, Natural Resources and Economic Development and University Extension to provide support to any future Missouri Forest Resource Council and to:
  1. Produce an informational campaign on the income possibilities from managing timber land properly for traditional products (sawtimber, veneer, posts, pulpwood, firewood, etc.) special forest products (burls, vines, pollen, seed, unique wood, etc.), and recreation products such as hunt-lease, group and other forms of forest recreation.

2. The working group should enter into a working agreement that ensures sharing of information regarding what each agency is doing in education in forestry.
3. Develop and provide oversight of the content of a landowner's educational program.
4. Deliver the educational program as a collaborative effort of the above organizations, but with the University of Missouri Outreach and Extension acting as the lead educational agency.

- Develop seminars to assist landowners in bidding and selling their standing timber.

- Institute a high intensity forest landowner education effort in the chip mill sourcing zones and include an evaluation of effectiveness.

- Establish an evaluation project to analyze forest landowner educational efforts. The evaluation is to be conducted by the Missouri Department of Conservation.

3. SUSTAINABLE ECONOMIC AND SOCIAL IMPACT

The Committee would like to see a healthy forest-based economy that would be sustained through time and support a forest resource that would provide a wide range of amenities and financial returns to both forestland owners and all Missouri citizens. Included in this vision are expanding employment opportunities in the forest products industry, with much of Missouri's forest resources being processed in the State, and a healthy and growing tourist industry in the Missouri Ozarks. It is important that forestland owners have the economic incentives and market opportunities to use sustainable management.

Recommendations

- Enhance the marketing efforts by the Departments of Agriculture and Economic Development to assist in the development of value-added forest products and export trade.

- Endorse the grant program for marketing and feasibility studies (HB 888) which could provide assistance for wood product companies to develop value-added agricultural business concepts that:
  1. Lead to and result in development, processing and marketing of new or expanded uses or technologies for agricultural products; and
  2. Foster agricultural economic development in Missouri's rural communities.

- Encourage the expansion of the research and development of alternative fiber sources for paper. The project would identify crops with high potential and create high yield varieties of alternative sources of raw materials.

- Encourage and support the development of forestry cooperatives for such things as marketing, management, export development and other business activities.

- Expand policies that encourage the paper manufacturing industry to increase the use of recovered paper and expand programs that require or promote the recovery of waste paper.

- Institute strategies that reduce the demand for virgin wood pulp, including promoting greater acceptance by the public and private sectors of lower grade paper stock in publications.

- The Missouri Department of Economic Development should make special efforts, working cooperatively with other agencies, to help small to mid-sized value-added forest products companies to locate or expand in Missouri.

- The Committee endorses the idea of focusing incentives on those firms and industry segments that through expansion or diversification can provide substantial new jobs (in the aggregate) as well as enhance the value-adding process to primary timber products.

- Have a reward and/or incentive to be given at the annual Governor's Economic Development Conference to a company demonstrating outstanding performance in wood waste recovery.

D. FINANCIAL SUPPORT

The potential for financing educational programs, incentives, and support of landowners who use sustainable management and BMPs received considerable attention from the Committee.

Recommendations

- Encourage producers to develop a statewide check-off program on timber sales modeled after the check-off program for other agricultural commodities. The revenue generated would be used to support a variety of programs, including research, marketing initiatives, value-added wood products and landowner and public education.

- Consider use of the revenues derived from the soil conservation portion of the Missouri Parks and Soils Sales Tax to sustain soil productivity for sustainable forest management and forest resources in Missouri within the guidelines of current legislation.

- Support the continued use of the Missouri Department of Conservation's Conservation Sales Tax as a source of funding for programs that enhance forestry programs.

- Reduce tax liability for timber owners who use sustainable management and Best Management Practices by
  1. Create a sliding scale of capital gains tax on the sale of timber.
  2. Expense management costs
  3. Recommend a double deduction for net cost of timber stand improvement.

4. Request Congress to raise the threshold on inheritance taxes and reduce rate of inheritance taxes.

- Special funding be provided by the Missouri Legislature to support the study of the environmental, economic and social impact of chip mills in the Missouri Ozarks.

E. OTHER

Recommendations

- It is paramount that legislative or administrative initiatives relative to timber management recognize the fundamental rights and responsibilities of property owners. This Committee believes property rights must be protected as consideration is given to increased regulation of Missouri's timber resources. We advocate policies and land use practices that protect our soil and water resources without unduly restricting landowners' discretion to make responsible land use decisions.

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GLOSSARY

Biodiversity – Diversity of organisms that exists at different scales (micro, meso, macro, etc.), as measured by the number of different species (richness) and their distribution over the landscape (evenness)

Biomass accumulation – A way of viewing the chronological progress of an ecosystem. Bormann and Likens (1979) proposed four phases of biomass accumulation following clearcutting of a northern hardwood ecosystem. Biomass accumulation looks at total productivity without regard to commercial value.

Board foot -- Unit of measure applied to roundwood. It relates to lumber that is 1 foot long, 1 foot wide, and 1 inch thick (or its equivalent).

Byproducts -- Primary wood products (e.g. pulp chips, animal bedding, fuelwood, etc.) recycled from mill residues.

Capital gains tax – Tax on income based on the *increase* in value of a capital investment.

Central hardwood region – The region south of the beech-maple forest, east of the Great Plains, and north and west of the southern pine forests of the Coastal Plain and Piedmont. The central hardwood forest covers an area of approximately 235,000 square miles and is centered along the axes of the Appalachian Mountains east of the Mississippi River and the Ouachita/Ozark Mountains west of the Mississippi.

Coarse mill residue -- Wood residue suitable for chipping such as slabs, edgings, and veneer cores.

Commercial species -- Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam, osage-orange, and redbud.)

Community – An assemblage of organisms living in an environment and interacting with each other and the environment. Each community possesses species that are adapted to the specific conditions that exist at the time.

Competition (for resources) – The interaction between plants that is a result of limited resources. For example, species such as oaks and hickories, with their better developed root systems, are more competitive on sites where moisture is limited.

Composite products -- Roundwood products manufactured into chips, wafers, strands, flakes, shavings or sawdust and then reconstituted into a variety of panel and engineered lumber products.

Cord -- Unit of measure applied to roundwood, usually bolts or split wood. It relates to stack of roundwood 4 feet high, 4 feet wide, and 8 feet long, containing 128 cubic feet of wood, bark, and air space.

Cull -- Net volume of rough and rotten trees plus the nongrowing stock portions of growing stock trees (stumps, tops, limbs, cull section of central stem).

Diameter at breast height (d.b.h.) -- The outside bark diameter at 4.5 feet above the forest floor on the uphill side of the tree. For determining breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line.

Disturbance – Forest disturbance is a component of the process of secondary succession and has played a significant part in the development of the central hardwood forest. Disturbances can come from within (endogenous), such as tree fall, native insect, or disease outbreak, or may come from outside agents (exogenous), such as fire, windstorm, and ice.

Ecosystem – An association in which the prevailing vegetation creates habitat for animal forms that are adapted to it, and they, in turn, have a biofeedback relationship with the vegetation. An assemblage of organisms that function in a particular environment, having interactions with their environment and with each other.

Even-aged management – A silvicultural system designed to totally remove an existing stand a create a new single-cohort stand. Even-aged management methods include clearcutting, seed-tree, and shelterwood systems. It is best suited to regenerate shade intolerant species.

Fiber products -- Byproducts used in the manufacture of pulp, paper, paperboard, and composite products, like waferboard, chip board, etc.

Fine mill residue -- Wood residue not suitable for chipping, such as sawdust and veneer clippings.

Forest Industry -- An ownership class of private lands owned by companies or individuals operating primary wood-using plants.

Forest land -- Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparing specified standards with basal area and /or number of trees, age or size, and spacing.) The minimum area for classification of forest land is 1 acre. Roadside, streamside, and

shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide.

Forest stand dynamics – Functional relationships in stands, such as how trees function where they compete with other trees in varying mixtures of species on different sites, at a variety of stocking densities and in varying age structures.

Fuelwood -- Roundwood products and mill residue byproducts used to produce some form of energy (heat, steam, etc.) in residential, industrial, or institutional settings.

Group selection -- An uneven-aged management method in which larger openings are created than in single-tree selection. It has the advantage of permitting regeneration of intermediate and shade intolerant species.

Growing-stock removals -- The growing-stock volume removed from poletimber and sawtimber trees in the timberland inventory. (Note: Includes volume removed for roundwood products, logging residues, and other removals).

Growing-stock tree -- A live timberland tree of commercial species that meets specified standards of size, quality, and merchantability. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume -- Net volume of growing-stock trees 5.0 inches d.b.h. and over, from 1 foot above the ground to a minimum 4.0 inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs.

Hardwoods -- Dicotyledonous trees, usually broad-leaved and deciduous.

High-grading – The practice of cutting the best and most desirable trees and leaving scattered poor quality and unmerchantable residual trees. If repeated over and over, high-grading will essentially leave stands of trees with low growth potential and can ultimately lead to an impoverished condition where few good management alternatives remain.

Industrial roundwood products -- Roundwood products (e.g. saw logs, pulpwood, veneer logs, etc.) intended to be processed into primary wood products (e.g. lumber, wood pulp, sheathing, etc.) at primary wood-using mills..

Intermediate cuttings – A silvicultural treatment, or combination of treatments, performed simultaneously that are used when stands are not ready for a final harvest.

International 1/4-inch -- A log rule, or formula, for estimating the board-foot volume of logs.

Landscape level – Viewing the ecosystem at a scale of tens to hundreds of square miles. At this

mesoscale level, macroclimate is relatively homogeneous, but elements such as soils, topography, and drainage basins may vary.

Logging residue -- The unused portions of trees cut, or killed by logging, and left in the woods.

Mean annual increment – Average annual volume growth over the length of the rotation.

Merchantable sections -- Refers to sections of the central stem of growing-stock trees that meet either pulpwood or saw-log specifications.

Mill residues -- Wood materials (coarse and fine) and bark generated at manufacturing plants (primary wood-using mills) when roundwood products are processed into primary wood products, includes slabs, edgings, trimmings, sawdust, veneer clippings and cores, and pulp screenings. (Note: Includes mill residues recycled as byproducts as well as those left unutilized and disposed of as waste.)

National Forest -- An ownership class of federal lands, designated by Executive Order or statute as National Forests or purchase units, and other lands under administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

Net volume -- Gross volume less deductions for rot, sweep, or other defects affecting use for roundwood products.

Noncommercial species -- Trees species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial roundwood products.

Nonforest land -- Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 39.9-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, improved roads and nonforest strips must be more than 120 feet wide and more than 1 acre to qualify as nonforest land.)

Nongrowing-stock removals -- The net volume removed from the nongrowing -stock portions of poletimber and sawtimber trees (stumps, tops, limbs, cull sections of central stem) and from any portion of a rough, rotten, sapling, dead, or nonforest tree.

Nonindustrial private -- An ownership class of private lands where the owner does not operate wood-using plants.

Nonindustrial roundwood products -- Roundwood products (fuelwood, posts, etc.) that are not milled (processed at a primary wood-using mill), but used directly for domestic/residential/local

purposes.

Northern hardwoods – The beech/maple/birch type consists of variuos mixtures of shade tolerant species, usually found at higher elevations in the central hardwood region.

Other public -- An ownership class that includes all public lands except National Forests.

Other removals – A USFS forest inventory category designating unutilized wood volume of trees cut or otherwise killed by cultural operations (e.g. precommercial thinnings) or landclearings to nonforest uses. Does not include volume removed from the inventory by reclassification of timberland to productive reserved forest land.

Poletimber -- A growing-stock tree at least 5.0 inches d.b.h. but smaller than sawtimber size (9.0 inches d.b.h. for softwoods, 11.0 inches d.b.h. for hardwoods).

Poletimber removals -- Net volume removed from the merchantable central stem (growing-stock portion) of poletimber.

Posts, poles, and pilings -- Roundwood products milled (cut, peeled, etc.) into standard sizes (lengths and circumferences) to be put in the ground to provide vertical and lateral support in buildings, foundations, utility lines and fences. May also include nonindustrial (unmilled).

Primary wood products -- The rough and finished products (lumber, wood pulp, veneer sheathing, handles, etc.) manufactured from roundwood products at primary wood-using mills.

Primary wood-using mills -- Mills that convert roundwood products (saw logs, veneer logs, pulpwood, etc.) into primary wood products, like lumber, sheathing, wood pulp, etc.

Productive reserved forestland -- Forest land that is withdrawn from timber utilization by statute or administrative regulation.

Pulpwood -- Roundwood logs, bolts, or chips reduced to individual wood fibers by chemical or mechanical means for the manufacture of a variety of paper and paperboard products.

Rotten tree -- A tree that does not meet regional merchantability standards because of excessive unsound cull.

Rough tree -- A tree that does not meet regional merchantability standards because of excessive sound cull. Includes noncommercial tree species.

Roundwood products -- Logs, bolts, or chips cut from trees for industrial and nonindustrial uses (sawlogs, veneer logs, pulpwood, fuelwood, etc.).

Sapling -- A live tree between 1.0 and 5.0 inches d.b.h.

Saw log -- A roundwood product, usually 8 feet in length or longer, processed into a variety of sawn products (lumber, cants, blocks, squares, etc.).

Saw-log portion -- That portion of the central stem of sawtimber trees between the stump and the saw-log top.

Saw-log top -- The point on the central stem of sawtimber trees above which a saw log can not be produced. The minimum saw-log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber removals -- The net volume removed from the merchantable central stem (growing-stock portion) of sawtimber trees (Note: includes the saw-log and upper-stem portions of sawtimber trees.) When referencing removals from the sawtimber inventory as in tables 4-6 of the timber removals tables, only the volume in the saw-log portion of sawtimber trees (sawtimber volume) removed for roundwood products, logging residue, and other removals is included, and is expressed in thousands of board feet (International 1/4-inch rule).

Sawtimber tree -- A growing-stock tree containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches d.b.h.

Sawtimber volume -- Net volume in the saw-log portion of sawtimber trees.

Severance tax – A tax on a fixed natural resource (e.g., on timber), following its removal from the natural site and therefore severance from the natural state. In most instances of its application, when timber is cut, the owner of the timber at that time must pay a severance tax.

Silvicultural system – A planned program of silvicultural treatment during the whole life of the stand; it not only includes reproduction cuttings, but also any tending operations or intermediate cuttings.

Silviculture – The theory and practice of controlling the establishment, composition, constitution, and growth of forests.

Single-tree selection -- An uneven-aged management method based on the removal of single mature trees. This technique simulates the natural gap dynamics that occurs in mature-unmanaged natural stands. This technique theoretically results in a balanced uneven-aged stand. This method leaves relatively small canopy gaps that can close fairly rapidly due to crown expansion of residual trees. Thus it promotes the regeneration of shade tolerant species.

Site -- The sum total of all environmental factors affecting the functioning of a forest community in a given locale (soil, climatic, and biotic factors).

Site index – Use of tree height growth as a measure of site quality. Height of dominant or codominant trees of a certain species (usually oaks) at 50 years of age is generally used in central hardwoods

Skid trails – Any surface, more or less prepared, over which logs are dragged.

Softwoods -- Coniferous trees, usually evergreen, having needles or scale-like leaves.

Source -- Identifies timber removals as coming from certain portions or types of trees. (Note: see poletimber removals, sawtimber removals, growing-stock removals, nongrowing-stock removals)

Stand -- A spatially continuous group of trees and associated vegetation having similar structures and growing under similar soil and climatic conditions. It is analogous to the ecological concept of 'community,' but focuses more on the trees and vegetation. A stand is a group of trees with similar age structure, species composition, site quality, and condition so as to be recognizable from adjacent stands. It is the basic unit of the forest to which a silvicultural treatment is applied.

Stand dynamics -- A term analogous to succession but focusing on the changes in forest stand structure with time, including stand behavior during and after disturbances.

Stocking – Refers to the occupancy of a site (number of trees or basal area per unit area) relative to the optimum the site can carry.

Succession -- An orderly change in community species composition over time, with each community possessing species that are adapted to the specific conditions that exist at that time. According to successional theory, ecosystems not subjected to strong exogenous disturbances change in a progressive and directional way.

Sustained yield – The yield that a forest can produce continuously at a given intensity of management. As forestry in America evolved as a profession, the term 'yield' has been broadened to include more than one commodity or use, although retaining a commodity focus.

Thinning – An intermediate cutting aimed at controlling stand density. The primary purpose of thinning is to redirect the resources of the site to the residual trees in order to improve their vigor and growth.

Timber Product Output.-- The total volume of roundwood products harvested from all sources plus the volume of byproducts recovered from mill residues.

Timber removals -- The total volume of trees removed by harvesting roundwood product, conducting cultural activities, and clearing forestlands. (Note: Includes roundwood products,

logging residues, and other removals).

Timberland -- Forest land that is producing, or is capable of producing, in excess of 20 cubic feet per acre per year of industrial roundwood products under natural conditions, is not withdrawn from timber utilization by statute or administrative regulation, and is not associated with urban or rural development.

Tops -- The wood of a tree above that of the central stem.

Tree -- A woody plant usually having one or more perennial stems, a more or less definitely formed crown of foliage, and a height of al least 12 feet at maturity.

Uneven-aged management -- Silvicultural systems that produce uneven-aged (multi-cohort) stands of shade tolerant species. In actuality, uneven-aged stands are aggregations of many small even-aged stands. Uneven-aged stands managed by single-tree methods ultimately tend to become dominated by shade tolerant species, since the size of stand openings is often too small to permit the successful regeneration of intolerant species.

Upper stem portion -- That portion of the central stem of sawtimber trees between the saw-log top and the minimum top diameter of 4.0 inches outside bark, or to the point where the central stem breaks into limbs.

Value added -- The difference between the sale price of the goods sold and the costs of the materials and supplies used in production.

Veneer log -- A roundwood product peeled, sliced, stamped or sawn into a variety of veneer products (sheathing, plywood, panels, containers, sticks, etc.).

Weight -- A unit of measure for mill residues, expressed as oven-dry tons (2000 oven-dry pounds).

Principal Sources for Definitions of Terms in Glossary :

U.S. Forest Service. Southern Research Station. Forest Inventory and Analysis (FIA) Program. Starkville, MS. Headquarters, Asheville, NC.

Hicks, R.R. 1998. *Ecology and Management of Central Hardwood Forests.* New York : John Wiley &Sons.

APPENDICES

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APPENDIX A

Additional Scenarios of Projected Growth and Drain in Missouri Based on Alternative Assumptions

Appendix A:

Additional Scenarios of Projected Growth and Drain in Missouri Based on Alternative Assumptions

Following are additions to the original scenarios for Mill Spring and Scott City procurement zones (presented in the June 1999 *Governor's Advisory Committee on Chip Mills: Forest Inventory, Growth, and Removals in Missouri,* pages 34 through 37). The scenarios in tables A-1 though A-8 use the original methodology with different assumptions. These scenarios explore the impacts of (a) increasing harvest levels for chip mills and (b) making permanent reductions in the volume of available wood due assumed landowner unwillingness to sell timber. Also, all of these scenarios increase the buffer for streams to 5% of the area (*i.e.*, reduce available timber by 5%); this was done to include buffers for both permanent and intermittent streams. The original scenarios used a 1% stream buffer based on miles of permanent rivers and streams. **Carefully examine the assumptions associated with each scenario. Assumed future harvest levels differ dramatically among scenarios.**

Table A-1. Revised scenario based on June 1999 report pages 34-37. Based on a 60-mile sourcing radius for Mill Spring and Scott City. Assumes chip mill harvest of 200 thousand tons at Mill Spring, 350 thousand tons at Scotty City, and 0 percent reduction for private lands unavailable for harvest. Increases buffer for permanent and intermittent streams to encompass 5% of the land area and timber volume. (Revised March, 2000, with improved estimates of growth and removals for Missouri and Illinois.)

Growing Stock	Mill	Spring	Scott	City
Standing volume (1989)	3064	Million cubic feet	2417	Million cubic feet
Annual growth	96	Million cubic feet	63	Million cubic feet
Annual removals	49	Million cubic feet	38	Million cubic feet
Annual growth in excess of removals	48	Million cubic feet	25	Million cubic feet
Annual growth in excess of removals	1428	Thousand tons	759	Thousand tons
Excess growth after reductions for species, road and stream buffers, public lands, steep slopes (53% Mill Spring[1]; 59% Scott City[2])	757	Thousand tons	446	Thousand tons
Excess growth after reduction for source area overlap (84%)	636	Thousand tons	375	Thousand tons
Chip Mill removals	200	Thousand tons	350	Thousand tons
Residual	436	Thousand tons	25	Thousand tons
Residual	15	Million cubic feet	1	Million cubic feet
Cull Volume	30793	Thousand tons	15506	Thousand tons
Cull remaining after same reductions as applied to growing stock volume	13709	Thousand tons	7685	Thousand tons
Equivalent supply for chip harvest.	69	Years	22	Years

[1]Adjustments for unusable species (22%), no public lands (27%), road buffers (1%), permanent and intermittent stream buffers (5%), steep slopes (1%).
[2]Adjustments for unusable species (22%), no public lands (19%), road buffers (1%), permanent and intermittent stream buffers (5%), steep slopes (1%).

Table A-2. Additional scenario based on June 1999 report pages 34-37. Based on a 60-mile sourcing radius for Mill Spring and Scott City. Assumes chip mill harvest of 300 thousand tons at Mill Spring, 350 thousand tons at Scotty City, and 0 percent reduction for private lands unavailable for harvest.

(Revised March, 2000, with improved estimates of growth and removals for Missouri and Illinois.)

Growing Stock	Mill	Spring	Scott	City
Standing volume (1989)	3064	Million cubic feet	2417	Million cubic feet
Annual growth	96	Million cubic feet	63	Million cubic feet
Annual removals	49	Million cubic feet	38	Million cubic feet
Annual growth in excess of removals	48	Million cubic feet	25	Million cubic feet
Annual growth in excess of removals	1428	Thousand tons	759	Thousand tons
Excess growth after reductions for species, road and stream buffers, public lands, steep slopes (53% Mill Spring[1]; 59% Scott City[2])	757	Thousand tons	446	Thousand tons
Excess growth after reduction for source area overlap (84%)	636	Thousand tons	375	Thousand tons
Chip Mill removals	300	Thousand tons	350	Thousand tons
Residual	336	Thousand tons	25	Thousand tons
Residual	11	Million cubic feet	1	Million cubic feet
Cull Volume	30793	Thousand tons	15506	Thousand tons
Cull remaining after same reductions as applied to growing stock volume	13709	Thousand tons	7685	Thousand tons
Equivalent supply for chip harvest.	46	Years	22	Years

[1]Adjustments for unusable species (22%), no public lands (27%), road buffers (1%), permanent and intermittent stream buffers (5%), steep slopes (1%).

[2]Adjustments for unusable species (22%), no public lands (19%), road buffers (1%), permanent and intermittent stream buffers (5%), steep slopes (1%).

Table A-3. Additional scenario based on June 1999 report pages 34-37. Based on a 60-mile sourcing radius for Mill Spring and Scott City. Assumes chip mill harvest of 600 thousand tons at Mill Spring, 600 thousand tons at Scotty City, and 0 percent reduction for private lands unavailable for harvest.

(Revised March, 2000, with improved estimates of growth and removals for Missouri and Illinois.)

Growing Stock	Mill	Spring	Scott	City
Standing volume (1989)	3064	Million cubic feet	2417	Million cubic feet
Annual growth	96	Million cubic feet	63	Million cubic feet
Annual removals	49	Million cubic feet	38	Million cubic feet
Annual growth in excess of removals	48	Million cubic feet	25	Million cubic feet
Annual growth in excess of removals	1428	Thousand tons	759	Thousand tons
Excess growth after reductions for species, road and stream buffers, public lands, steep slopes (53% Mill Spring[1]; 59% Scott City[2])	757	Thousand tons	446	Thousand tons
Excess growth after reduction for source area overlap (84%)	636	Thousand tons	375	Thousand tons
Chip Mill removals	600	Thousand tons	600	Thousand tons
Residual	36	Thousand tons	-225	Thousand tons
Residual	1	Million cubic feet	-7	Million cubic feet
Cull Volume	30793	Thousand tons	15506	Thousand tons
Cull remaining after same reductions as applied to growing stock volume	13709	Thousand tons	7685	Thousand tons
Equivalent supply for chip harvest.	23	Years	13	Years

[1]Adjustments for unusable species (22%), no public lands (27%), road buffers (1%), permanent and intermittent stream buffers (5%), steep slopes (1%).

[2]Adjustments for unusable species (22%), no public lands (19%), road buffers (1%), permanent and intermittent stream buffers (5%), steep slopes (1%).

Table A-4. Additional scenario based on June 1999 report pages 34-37. Based on a 60-mile sourcing radius for Mill Spring and Scott City. Assumes chip mill harvest of 1,000 thousand tons at Mill Spring, 1,000 thousand tons at Scotty City, and 0 percent reduction for private lands unavailable for harvest.
(Revised March, 2000, with improved estimates of growth and removals for Missouri and Illinois.)

Growing Stock	Mill	Spring	Scott	City
Standing volume (1989)	3064	Million cubic feet	2417	Million cubic feet
Annual growth	96	Million cubic feet	63	Million cubic feet
Annual removals	49	Million cubic feet	38	Million cubic feet
Annual growth in excess of removals	48	Million cubic feet	25	Million cubic feet
Annual growth in excess of removals	1428	Thousand tons	759	Thousand tons
Excess growth after reductions for species, road and stream buffers, public lands, steep slopes (53% Mill Spring[1]; 59% Scott City[2])	757	Thousand tons	446	Thousand tons
Excess growth after reduction for source area overlap (84%)	636	Thousand tons	375	Thousand tons
Chip Mill removals	1000	Thousand tons	1,000	Thousand tons
Residual	-364	Thousand tons	-625	Thousand tons
Residual	-12	Million cubic feet	-21	Million cubic feet
Cull Volume	30793	Thousand tons	15506	Thousand tons
Cull remaining after same reductions applied to growing stock available volume	13709	Thousand tons	7685	Thousand tons
Equivalent supply for chip harvest.	14	Years	8	Years

[1]Adjustments for unusable species (22%), no public lands (27%), road buffers (1%), permanent and intermittent stream buffers (5%), steep slopes (1%).
[2]Adjustments for unusable species (22%), no public lands (19%), road buffers (1%), permanent and intermittent stream buffers (5%), steep slopes (1%).

Table A-5. Additional scenario based on June 1999 report pages 34-37. Based on a 60-mile sourcing radius for Mill Spring and Scott City. Assumes chip mill harvest of 200 thousand tons at Mill Spring, 350 thousand tons at Scotty City. Assumes that only 80% of land base is available for harvest and that ALL private and public timber lands have reductions for road buffers (1%), steep slopes (1%), permanent and intermittent streams (5%). Public lands and unacceptable species are removed from available harvest for chip mills.
(Revised March, 2000, with improved estimates of growth and removals for Missouri and Illinois.))

Growing Stock	**Mill**	**Spring**	**Scott**	**City**
Standing volume (1989)	3064	Million cubic feet	2417	Million cubic feet
Annual growth	96	Million cubic feet	63	Million cubic feet
Reductions for unwilling sellers (80% available)	77	Million cubic feet	50	Million cubic feet
Reductions for road buffers, stream buffers, and steep slopes (93%)	72	Million cubic feet	47	Million cubic feet
Annual removals	49	Million cubic feet	38	Million cubic feet
Annual growth in excess of removals	23	Million cubic feet	9	Million cubic feet
Annual growth in excess of removals	692	Thousand tons	268	Thousand tons
Excess growth after reductions for species and public lands (57% Mill Spring[1]; 63% Scott City[2])	395	Thousand tons	169	Thousand tons
Excess growth after reduction for source area overlap (84%)	332	Thousand tons	142	Thousand tons
Chip Mill removals	200	Thousand tons	350	Thousand tons
Residual	132	Thousand tons	-208	Thousand tons
Residual	4	Million cubic feet	-7	Million cubic feet
Cull Volume	30793	Thousand tons	15506	Thousand tons
Cull remaining after same reductions applied to growing stock available volume	10969	Thousand tons	6130	Thousand tons
Equivalent supply for chip harvest.	55	Years	18	Years

[1]Adjustments for unusable species (22%), no public lands (27%).
[2]Adjustments for unusable species (22%), no public lands (19%).

Table A-6. Additional scenario based on June 1999 report pages 34-37. Based on a 60-mile sourcing radius for Mill Spring and Scott City. Assumes chip mill harvest of 300 thousand tons at Mill Spring, 350 thousand tons at Scotty City. Assumes that only 80% of land base is available for harvest and that ALL private and public timber lands have reductions for road buffers (1%), steep slopes (1%), permanent and intermittent streams (5%). Public lands and unacceptable species are removed from available harvest for chip mills.
(Revised March, 2000, with improved estimates of growth and removals for Missouri and Illinois.)

Growing Stock	***Mill***	**Spring**	**Scott**	**City**
Standing volume (1989)	3064	Million cubic feet	2417	Million cubic feet
Annual growth	96	Million cubic feet	63	Million cubic feet
Reductions for unwilling sellers (80% available)	77	Million cubic feet	50	Million cubic feet
Reductions for road buffers, stream buffers, and steep slopes (93%)	72	Million cubic feet	47	Million cubic feet
Annual removals	49	Million cubic feet	38	Million cubic feet
Annual growth in excess of removals	23	Million cubic feet	9	Million cubic feet
Annual growth in excess of removals	692	Thousand tons	268	Thousand tons
Excess growth after reductions for species and public lands (57% Mill Spring[1]; 63% Scott City[2])	395	Thousand tons	169	Thousand tons
Excess growth after reduction for source area overlap (84%)	332	Thousand tons	142	Thousand tons
Chip Mill removals	300	Thousand tons	350	Thousand tons
Residual	32	Thousand tons	-208	Thousand tons
Residual	1	Million cubic feet	-7	Million cubic feet
Cull Volume	30793	Thousand tons	15506	Thousand tons
Cull remaining after same reductions applied to growing stock available volume	10969	Thousand tons	6130	Thousand tons
Equivalent supply for chip harvest.	37	Years	18	Years

[1]Adjustments for unusable species (22%), no public lands (27%).
[2]Adjustments for unusable species (22%), no public lands (19%).

Table A-7. Additional scenario based on June 1999 report pages 34-37. Based on a 60-mile sourcing radius for Mill Spring and Scott City. Assumes chip mill harvest of 600 thousand tons at Mill Spring, 600 thousand tons at Scotty City. Assumes that only 80% of land base is available for harvest and that ALL private and public timber lands have reductions for road buffers (1%), steep slopes (1%), permanent and intermittent streams (5%). Public lands and unacceptable species are removed from available harvest for chip mills.
(Revised March, 2000, with improved estimates of growth and removals for Missouri and Illinois.))

Growing Stock	**Mill**	**Spring**	**Scott**	**City**
Standing volume (1989)	3064	Million cubic feet	2417	Million cubic feet
Annual growth	96	Million cubic feet	63	Million cubic feet
Reductions for unwilling sellers (80%)	77		50	
Reductions for road buffers, stream buffers, and steep slopes (93%)	72		47	
Annual removals	49	Million cubic feet	38	Million cubic feet
Annual growth in excess of removals	23	Million cubic feet	9	Million cubic feet
Annual growth in excess of removals	692	Thousand tons	268	Thousand tons
Excess growth after reductions for species and public lands (57% Mill Spring[1]; 63% Scott City[2])	395	Thousand tons	169	Thousand tons
Excess growth after reduction for source area overlap (84%)	332	Thousand tons	142	Thousand tons
Chip Mill removals	600	Thousand tons	600	Thousand tons
Residual	-268	Thousand tons	-458	Thousand tons
Residual	-9	Million cubic feet	-15	Million cubic feet
Cull Volume	30793	Thousand tons	15506	Thousand tons
Cull remaining after same reductions applied to growing stock available volume	10969	Thousand tons	6130	Thousand tons
Equivalent supply for chip harvest.	18	Years	10	Years

[1]Adjustments for unusable species (22%), no public lands (27%).
[2]Adjustments for unusable species (22%), no public lands (19%).

Table A-8. Additional scenario based on June 1999 report pages 34-37. Based on a 60-mile sourcing radius for Mill Spring and Scott City. Assumes chip mill harvest of 1,000 thousand tons at Mill Spring, 1,000 thousand tons at Scotty City. Assumes that only 80% of land base is available for harvest and that ALL private and public timber lands have reductions for road buffers (1%), steep slopes (1%), permanent and intermittent streams (5%). Public lands and unacceptable species are removed from available harvest for chip mills.
(Revised March, 2000, with improved estimates of growth and removals for Missouri and Illinois.)

Growing Stock	**Mill**	**Spring**	**Scott**	**City**
Standing volume (1989)	3064	Million cubic feet	2417	Million cubic feet
Annual growth	96	Million cubic feet	63	Million cubic feet
Reductions for unwilling sellers (80% available)	77	Million cubic feet	50	Million cubic feet
Reductions for road buffers, stream buffers, and steep slopes (93%)	72	Million cubic feet	47	Million cubic feet
Annual removals	49	Million cubic feet	38	Million cubic feet
Annual growth in excess of removals	23	Million cubic feet	9	Million cubic feet
Annual growth in excess of removals	692	Thousand tons	268	Thousand tons
Excess growth after reductions for species and public lands (57% Mill Spring[1]; 63% Scott City[2])	395	Thousand tons	169	Thousand tons
Excess growth after reduction for source area overlap (84%)	332	Thousand tons	142	Thousand tons
Chip Mill removals	1000	Thousand tons	1000	Thousand tons
Residual	-668	Thousand tons	-858	Thousand tons
Residual	-22	Million cubic feet	-29	Million cubic feet
Cull Volume	30793	Thousand tons	15506	Thousand tons
Cull remaining after same reductions applied to growing stock available volume	10969	Thousand tons	6130	Thousand tons
Equivalent supply for chip harvest.	11	Years	6	Years

[1]Adjustments for unusable species (22%), no public lands (27%).
[2]Adjustments for unusable species (22%), no public lands (19%).

APPENDIX B

Governor's Advisory Committee on Chip Mills :

Committee Members

5-10-2000

GOVERNOR'S ADVISORY COMMITTEE ON CHIP MILLS
(14 Members)

1. Mark S. Garnett West Plains, MO	Forest products representative
2. Jon D. Smith Mountain View, MO	Forest products representative
3. Jay R. Law St. James, MO (May 1999 – Present) Dierdre K. Hirner Columbia, MO (November 1998 – April 1999)	Citizen environmental conservation group
4. David E. Bedan Columbia, MO	Citizen environmental conservation group
5. Emily R. Firebaugh Farmington, MO	Forest landowner
6. David A. Day Dixon, MO	Private property owner organization representative
7. Senator Wayne Goode St. Louis, MO	Senator
8. Senator Doyle Childers Reeds Spring, MO	Senator
9. Rep. Jerry McBride Edgar Springs, MO	Representative
10. Rep. Bill Foster Poplar Bluff, MO	Representative

11. Stephen Mahfood — Department of Natural Resources
    Director – Department of Natural Resources
    Jefferson City, MO

12. Jerry Conley — Department of Conservation
    Director - Department of Conservation
    Jefferson City, MO
    (September 1999 to Present)
    Marvin Brown
    Jefferson City, MO
    (November 1998 to August 1999)

13. Joseph L. Driskill — Department of Economic Development
    Director – Department of Economic Development
    Jefferson City, MO
    (January 2000 to Present)
    Earl Cannon
    Jefferson City, MO
    (November 1998 to December 1999)

14. John L. Saunders — Department of Agriculture
    Director – Department of Agriculture
    Jefferson City, MO
    (January 2000 to Present)
    Sarah Tyree
    Jefferson City, MO
    (November 1998 to December 1999)

APPENDIX C

Recommendations (with Votes)
Governor's Advisory Committee on Chip Mills

April 9 and 10, 2000

Recommendations (with Votes) from the Advisory Committee on Chip Mills
April 9 and 10, 2000

Bedan – David E. Bedan
Childers – Senator Doyle Childers
Conley – Jerry Conley
Day – David A. Day
Driskill – Joseph L. Driskill
Firebaugh – Emily R. Firebaugh
Foster – Representative Bill Foster
Garnett – Mark S. Garnett
Goode – Senator Wayne Goode
Law – Jay R. Law
Mahfood – Stephen Mahfood
McBride – Representative Jerry McBride
Saunders – John L. Saunders
Smith – Jon D. Smith

SUSTAINABLE ECONOMIC AND SOCIAL IMPACTS

"Enhance the marketing efforts by the Departments of Agriculture and Economic Development to assist in the development of value-added forest products and export trade."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Endorse the grant program for marketing and feasibility studies (HB 888) which could provide assistance for wood product companies to develop value-added agricultural business concepts that:
1. Lead to and result in development, processing and marketing of new or expanded uses or techniques for agricultural products; and
2. Foster agricultural economic development in Missouri's rural communities."

Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Encourage the expansion of the research and development of alternative fiber sources for paper. The project would identify crops with high potential and create high yield varieties of alternative sources of raw materials."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Encourage and support the development of forestry cooperatives for such things as marketing, management, export development and other business activities."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Applicants for state discretionary incentives should include the name and credentials of the professional forester who has responsibility for supervising timber harvesting and procurement activities for the applicant for the proposed new facility or expansion."
No
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Establish an evaluation project to analyze forest landowner educational efforts. The evaluation is to be conducted by the Missouri Department of Conservation."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"Establish some mechanism such as through a permit system that requires the high capacity chip mills to use a high percentage of cull, rough and rotten trees."
Yes
Bedan, Driskill, Goode, Mahfood, Saunders, Smith
No
Childers, Conley, Day, Firebaugh, Foster, Garnett, Law
Absent
McBride

"Expand policies that encourage the paper manufacturing industry to increase the use of recovered paper and expand programs that require or promote the recovery of waste paper."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"Institute strategies that reduce the demand for virgin wood pulp, including promoting greater acceptance by the public and private sectors of lower grade paper stock in publications."
Yes
Bedan, Childers, Conley, Day, Foster, Garnett, Goode, Mahfood, Saunders, Smith
No
Driskill, Firebaugh, Law
Absent
McBride

"The Missouri Department of Economic Development should make special efforts, working cooperatively with other agencies, to help small to mid-sized value-added forest products companies to local or expand in Missouri."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"The Committee endorses the idea of focusing incentives on those firms and industry segments that through expansion or diversification can provide substantial new jobs (in the aggregate) as well as enhance the value-adding process to primary timber products."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"Create a system to permit wood waste recovery facilities and provide incentives for those facilities using a certain percentage of waste wood."
Yes
Bedan, Driskill, Goode, Mahfood, Saunders, Smith
No
Childers, Conley, Day, Firebaugh, Foster, Garnett, Law
Absent
McBride

"Have a reward and/or incentive to be given at the annual Governor's Economic Development Conference to a company demonstrating outstanding performance in wood waste recovery."
Yes
Bedan, Childers, Conley, Day, Garnett, Mahfood, Saunders, Smith
No
Firebaugh, Law
Absent
Driskill, Foster, Goode, McBride

EDUCATION, TRAINING AND PROFESSIONAL MANAGEMENT

Logger Training

"Support the existing Statewide Certification Training Program for Loggers and create incentives for voluntary logger certification and encourage the use of such trained loggers in timber harvesting and maintain a list of such certified loggers."
Yes
Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Bedan, Driskill, Foster, Goode, McBride

"Establish a Board for Professional Loggers in the Division of Professional Registration of the Missouri Department of Economic Development."
No
Childers, Conley, Day, Garnett, Law, Mahfood, Saunders, Smith
Abstain
Bedan, Firebaugh
Absent
Driskill, Foster, Goode, McBride

"Create incentives for logger certification by requiring that a Missouri Department of conservation certified logger be on-site during harvesting."
Yes
Bedan, Firebaugh, Law, Mahfood, Saunders
No
Childers, Conley, Day, Garnett, Smith
Absent
Driskill, Foster, Goode, McBride

"Encourage the formation of a coalition of forest landowners that would agree to use only trained loggers and implement sustainable forestry principles."
Yes
Bedan, Childers, Conley, Day, Garnett, Law, Mahfood, Saunders, Smith
No
Firebaugh
Absent
Driskill, Foster, Goode, McBride

Professional Foresters

"Establish licensing for persons with four-year degrees (BSF or higher) from Society of American Foresters (SAF) accredited Universities or Colleges."
Yes
Conley, Firebaugh
No
Bedan, Childers, Day, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Establish a Professional Registry Board for professional licensed foresters to practice in Missouri."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Require high capacity chip mills to purchase timber only from harvests that have been done by licensed professional foresters who certify the use of BMPs in the harvest."
Yes
Bedan, Goode, Mahfood, Saunders
No
Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Law, Smith
Absent
McBride

Landowner Education

"Conduct a comprehensive evaluation of all existing forest landowner education programs in Missouri."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, Law, McBride

"The University of Missouri Outreach and Extension in conjunction with MDC foresters offer silviculture courses throughout the state in an intensive educational drive for five years."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, Law, McBride

"Expand the Forest Cropland or Stewardship programs already in place and aggressively market them to enroll landowners in the programs."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, Law, McBride

"Establish working group of the Departments of Agriculture, Conservation, Natural Resources and Economic Development and University Extension to provide support to any future Missouri Forest Resource Council and to:

1. Produce an informational campaign on the income possibilities from managing timberland properly for traditional products (sawtimber, veneer, posts, pulpwood, firewood, etc.) special forest products (burls, vines, pollen, seed, unique wood, etc.), and recreation products such as hunt-lease, group and other forms of forest recreation.
2. The working group should enter into a working agreement that ensures sharing of information regarding what each agency is doing in education in forestry.
3. Develop and provide oversight of the content of a landowner's educational program.
4. Deliver the educational program as a collaborative effort of the above organizations, but with the University of Missouri Outreach and Extension acting as the lead educational agency."

Yes
Bedan, Childer, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders
Absent
Driskill, Foster, Goode, McBride, Smith

"Develop seminars to assist landowners in bidding and selling their standing timber."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders
Absent
Driskill, Foster, Goode, McBride, Smith

"Institute a high intensity forest landowner education effort in the chip mill sourcing zones and include an evaluation of effectiveness."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood
Absent
Driskill, Foster, Goode, McBride, Saunders, Smith

"Fund a pilot project to encourage landowners to do timberland improvements such as thinnings, removal of culls, etc., in lieu of liquidation and/or timberland conversion to pasture or other uses."
Yes
Garnett
No
Bedan, Childers, Conley, Day, Firebaugh, Law, Mahfood, Saunders
Absent
Driskill, Foster, Goode, McBride, Smith

"Develop an outcomes/impact assessment to see how the voluntary approach is working. If working, then the programs should be continued. If not, then the voluntary approach will need to be reassessed."
Yes
Bedan, Childers, Mahfood, Saunders
No
Conley, Day, Firebaugh, Garnett, Law
Absent
Driskill, Foster, Goode, McBride, Smith

ENVIRONMENTAL SUSTAINABILITY

Pollution Reduction

"Money to address soil erosion on forestland should be made available from the Soil and Water Conservation Fund."
Yes
Bedan, Mahfood
No
Childers, Conley, Day, Firebaugh, Garnett, Law, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

Forest Practices Act

"A Forest Practices Act that includes mandatory use of BMPs, harvest notification, logger and forester certification, and a harvest plan should be passed."
Yes
Bedan, Goode, Mahfood
No
Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Law, Saunders, Smith
Absent
McBride

Resource Recovery

"Legislation should be passed to establish authority for determining the characteristics of the timber used by high capacity chip mills."
Yes
Bedan, Childers, Conley, Driskill, Foster, Goode, Law, Mahfood, Saunders, Smith
No
Day, Firebaugh, Garnett
Absent
McBride

Sustainable Forest Resources Act and Forest Resources Council

"Update State Forestry Law to include new incentives intended to increase participation in the program and ensure long-term forest resource sustainability for Missouri. Best Management Practices shall be utilized as a general requirement for any forest landowner receiving assistance under such program."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Mahfood, Saunders, Smith
Absent
Law, McBride

"Recommend a revision of the State's Forestry Act to provide for a minimum of $10/acre annual payment as an incentive for those who put their land in Forest Crop and subscribe to BMPs and allowing access to their lands by MDC. (Continue as a voluntary program with taxes deferred for lands in the program and a yield tax on harvested volume. Repeal the $400 per acre value limitation and reduce the sign-up obligation to 10 years as added incentives)"
No
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Mahfood, Saunders, Smith
Absent
Law, McBride

"A Forest Resources Council should be established. The Council would serve at least four roles:
1. Foster collaboration and provide an ongoing public forum among landowners, loggers, wood-based industries, environmental interests, the tourism industry, public agencies and others with a vital vested interest in the well-being of Missouri's forest resource.
2. Advise the governor and state, county and local governments on sustainable forest resource policies and practices.
3. Coordinate priority forestry research efforts in the state and develop and implement initiatives in sustainable forest management.
4. Appointments shall be submitted by the groups involved and confirmed by the Senate, assigned to the Department of Conservation for administrative support."

Yes
Bedan, Childers, Conley, Law, Mahfood, Saunders, Smith
No
Day, Firebaugh, Garnett
Absent
Driskill, Foster, Goode, McBride

Ensuring BMPs

"An interagency task force of the Departments of Conservation, Natural Resources and Agriculture; a representative of industry, and environmental organization, and professional forestry organization; and the School of Forestry and Natural Resources, University of Missouri, should be created to evaluate the present definition of "Best Management Practices" by January 1, 2002."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Develop an incentive approach to sustainable forestry management and use of BMPs."
Yes
Bedan, Garnett, Mahfood, Saunders
No
Childers, Conley, Day, Firebaugh, Law, Smith
Absent
Driskill, Foster, Goode, McBride

"Require chip mills and other forest products companies to obtain their timber supplies from loggers trained in Best Management Practices."
Yes
Bedan, Goode, Mahfood
No
Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Law, Saunders, Smith
Absent
McBride

"It is the interest of the state of Missouri that owners of forest lands use Best Management Practices (BMP) based on "Missouri Watershed Protection Practices" published by the Missouri Department of Conservation with Missouri's Department of Natural Resources and other agencies, to protect soil and water resources for current and future generations of Missourians.

It is the purpose of this Act to include that BMP will be carried out within the sensitive portions of riparian areas and where the forest cover is to be greatly reduced on sizable areas of land to protect water quality, especially in the karst topography of the Ozark Region where soils are inherently low in fertility and the landscape is more dissected.

The use of best management practices is voluntary except: when a landowner, trustee, timber deed holder or assignee plans to remove 50% or more of the forest cover (measured by trees 5.0 inches in diameter at breast height, 4.5 feet in height) on more than 40 contiguous acres of forest land within one year within the Ozark Regions.

A Missouri Timber Harvest Permit must be obtained in advance for those situations where BMPs are required under paragraph 2 above. Permits to be issued by the Missouri Department of Conservation. The issued permit grants access to the Department for the sole purpose of inspecting the permitted area(s)."
Yes
Bedan, Conley, Driskill, Goode, Law, Mahfood, Saunders, Smith
No
Childers, Day, Firebaugh, Foster, Garnett
Absent
McBride
NOTE:
Three votes were taken on this issue. The second and third votes related to adding the word "contiguous" in the third paragraph.

The second vote was taken to add the word "contiguous." The votes were:
Yes
Childers, Conley, Day, Driskill, Foster, Garnett, Law, Saunders, Smith
No
Bedan, Firebaugh, Mahfood
Absent
Goode, McBride

The third vote was taken as an overall approval with the change. The votes were:
Yes
Bedan, Conley, Driskill, Law, Mahfood, Saunders, Smith
No
Childers, Day, Firebaugh, Foster, Garnett
Absent
Goode, McBride

"New chip mills locating in Missouri should be required to obtain timber only from sources using BMPs."
Yes
Bedan, Goode, Mahfood, Saunders, Smith
No
Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Law
Absent
McBride

"Amend the State Forestry Law to require all timberland owners to pay a 6% timber severance fee based on gross income from the sale of timber products and then provide income tax credits if the following criteria are met.

1. The timberland owner has secured the assistance of a Licensed Forester or a State Forester to develop a plan for the sustainability of the forest resources.
2. A timber sale contract requiring "Best Management Practices" is employed to protect the water and soil resources of the owners and adjoining neighbors' properties.
3. Licensed Loggers are used resulting in "Best Management Practices" being carried out as a part of harvesting operations."

No
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

Information Base

"Develop a database about forest resources in Missouri similar to what is presently done for agriculture in the Census of Agriculture. The database needs to include:

1. Forest land ownership
2. An annual inventory and survey of forest resources and use."

Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Institute a long term research effort, focused in the chip mill sourcing zones utilizing remote sensing, to investigate harvest site, location, methodology and use of Best Management Practices."

Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"The long-term research effort should consider:

1. An annual inventory intensive enough to detect resource changes in a short time period.
2. Can technology detect changes in size class distribution?
3. Can remote sensing be used to help determine the impacts of forest fragmentation?"

Yes
Bedan, Childers, Conley, Day, Firebaugh, Law, Mahfood, Saunders, Smith
No
Garnett
Absent
Driskill, Foster, Goode, McBride

"The Committee supports a system of voluntary harvest pre-notification to the Missouri Department of Conservation of commercial timber harvests as a means to disseminate forest management information to landowners and to aid in the collection of information on extent and type of timber harvests, type of forest management used, and the use of Best Management Practices on timber harvests on private land."
Yes
Childers, Conley, Day, Law, Saunders, Smith
No
Bedan, Firebaugh, Mahfood
Absent
Driskill, Foster, Garnett, Goode, McBride

Other

"Companies should be encouraged to use the principles of the Sustainable Forest Initiative or other certification programs on all forestlands and participate in a verification process."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Responsible parties should be fined based on the environmental degradation their actions have caused. The resulting fund would then be used for a combination of education, incentives, regulation and monitoring."
Yes
Bedan, Childers, Conley, Firebaugh, Foster, Mahfood, Saunders, Smith
No
Day, Garnett, Law
Absent
Driskill, Goode, McBride

FINANCIAL SUPPORT

Financing

"Encourage producers to develop a statewide check-off program on timber sales modeled after the check-off program for other agricultural commodities. The revenue generated would be used to support a variety of programs, including research, marketing initiatives, value-added wood products and landowner and public education."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"Consider the use of revenues derived from the soil conservation portion of the Missouri Parks and Soils Sales Tax to sustain soil productivity for sustainable forest management and forest resources in Missouri within the guidelines of current legislation."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Support the continued use of the Missouri Department of Conservation's Conservation Sales Tax as a source of funding for programs that enhance forestry programs."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Mahfood, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

"Require a Conservation Bond by timber owners prior to harvesting. Refund when sustainable forest management and BMPs are used."
Yes
Bedan, Conley, Goode, Mahfood, Saunders
No
Childers, Day, Driskill, Firebaugh, Foster, Garnett, Law, Smith
Absent
McBride

"Enact a severance tax to be assessed on timber harvest to be returned as incentive for using sustainable forest management and BMPs."
Yes
Bedan, Conley, Goode, Mahfood, Saunders
No
Childers, Day, Driskill, Firebaugh, Foster, Garnett, Law, Smith
Absent
McBride

"Support Missouri Conservation Commission's further consideration of possible use of a yield tax to encourage forest sustainability."
Yes
Bedan, Conley, Driskill, Goode, Mahfood, Saunders
No
Childers, Day, Firebaugh, Foster, Garnett, Law, Smith
Absent
McBride

"Provide tax credits for timber owners to use recommended practices, planning and management.
1. Provide a tax credit if BMPs were used with a licensed, certified or accredited forestry consultant and loggers.
2. Provide a tax credit on a standing timber sale if the harvest was at least 15% cull, rough, rotten and/or trash wood.
3. Institute a reforestation tax credit with a yearly limit to landowners who replant idle, or cutover timberland.
4. Give a tax credit for the cost of the programs to those who are certified as using BMPs"

Yes
Garnett
No
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"Reduce tax liability for timber owners who use sustainable management and BMP by:"
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride
Votes taken separately on each of the following paragraphs for inclusion or not, or re-wording:
To delete in its entirety:
"1. Exclude a percentage of timber income from income tax liability."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Goode, Law, Mahfood, Saunders, Smith
No
Garnett
Absent
McBride

"2. Create a sliding scale on capital gains tax on the sale of timber."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnet, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"3. Reduce the inheritance tax liability on timberland."
Two votes were taken on whether to retain the previous wording with the final vote being:
Yes
Garnett

No
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"4. Expense management costs."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"5. Recommend a double deduction for net cost of timber stand improvement."
Yes
Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Law, Smith
No
Bedan, Goode, Mahfood, Saunders
Absent
McBride

"6. Request Congress to raise the threshold on inheritance taxes and reduce rate of inheritance taxes."
Yes
Bedan, Childers, Conley, Day, Driskill, Firebaugh, Foster, Garnett, Goode, Law, Mahfood, Saunders, Smith
Absent
McBride

"Have a discount in workman compensation costs if loggers, sawyers, and millers are licensed and/or trained to ensure quality of the work site and BMPs."
Yes
Firebaugh, Mahfood
No
Bedan, Childers, Conley, Day, Garnett, Law, Saunders, Smith
Absent
Driskill, Foster, Goode, McBride

GENERAL ISSUES

"A moratorium on issuing new permits to high capacity chip mills until more hard information is available on the environmental, economic and social impact of their presence in the Missouri Ozarks. (3 year state funded study by MDC, DNR, UMC, EPA and USFS-Research)"
Yes
Bedan, Driskill, Goode, Mahfood, Saunders, Smith

No
Childers, Conley, Day, Firebaugh, Foster, Garnett, Law
Absent
McBride

"Loggers and timber buyers be registered or licensed by a board as one step towards bringing Best Management Practices into the harvesting of privately owned timber and to help landowners acquire the services of trained loggers. (MFPA-MDC to provide training and certification of training with registration or licensing at the state level.)"
Yes
Bedan, Firebaugh, Law, Mahfood, Saunders
No
Childers, Conley, Day, Garnett, Smith
Absent
Driskill, Foster, Goode, McBride

"Develop and evaluate effective forest landowner education programs under the direction of the Missouri Forest Resource Council. MFRC to over-see and recommend development of educational programs and legislation that assist owners in learning about the care of their forest resources and the protection of soil and water quality during timber harvesting. (Coordinate local education program involving the MDC, DNR, Agr., UMC, Farm Bureau, MFPA, FFA advisors, RC&D, NRSCS, and the Soil Conservation Districts. Include timber prices trends in information reported on the sale of farm products.)"
Yes
Bedan, Law, Mahfood, Saunders
No
Childers, Conley, Day, Firebaugh, Garnett
Absent
Driskill, Foster, Goode, McBride, Smith

"Special funding be provided by the Missouri Legislature to support the study of the environmental, economic and social impact of chip mills in the Missouri Ozarks."
Yes
Bedan, Childers, Conley, Day, Firebaugh, Law, Mahfood, Saunders, Smith
No
Garnett
Absent
Driskill, Foster, Goode, McBride

"It is paramount that legislative or administrative initiatives relative to timber management recognize the fundamental rights and responsibilities of property owners. This Committee believes property rights must be protected as consideration is given to increased regulation of Missouri's timber resources. We advocate policies and land use practices that protect our soil and water resources without unduly restricting landowners' discretion to make responsible land use decisions."

Yes
Bedan, Childers, Conley, Day, Firebaugh, Garnett, Law, Saunders, Smith
No
Mahfood
Absent
Driskill, Foster, Goode, McBride

Vote was taken to add the following paragraph.
"We believe that Missouri's natural resources must be protected and that landowners have an obligation to protect those resources."
Yes
Bedan, Childers, Mahfood, Smith
No
Conley, Day, Firebaugh, Garnett, Law, Saunders
Absent
Driskill, Foster, Goode, McBride

Removed from consideration since they were discussed under other items:

Develop new financing incentives and use along with existing incentives to:
1. Facilitate the purchase of equipment resulting in greater efficiency.
2. Expand recycling of waste products.
3. Create more and better jobs in industries that add significant value to the product.

Legislation should be passed to establish authority for resource recovery certification of high capacity chip mills in the state, whereby a minimum percentage of a facility's feedstock is required to be waste wood.

Institute a moratorium on new high capacity chip mills in the state until further information/study on their potential effects of the forest resource is obtained/completed.

That a Missouri Forest Resource Council (MFRC) be established by the legislature to coordinate, evaluate and study programs important to Missouri's private forestlands and to study and to make recommendations on legislature. (Similar in makeup of this committee with major groups represented. The MFRC to make recommendations concerning BMP's a Missouri Forest Practices Act and other needed legislation and to serve as the overseers and the appeal board for acts, rules, and codes related to private forest lands.)

APPENDIX D

Acknowledgments

The Governor's Advisory Committee on Chip Mills wishes to express its appreciation to the many individuals who provided information and assistance in the process of carrying out its tasks. These include individuals who compiled reports requested by the Committee, those who gave formal presentations at Committee hearings, those who contributed information included in sections of the report, and those who assisted the Committee in the variety of process-related activities necessary for the successful completion of its work. The Committee owes a debt of gratitude to the following:

Reports compiled for the Committee :

John P. Dwyer, University of Missouri, School of Natural Resources, Department of Forestry, Columbia, MO
Stephen R. Shifley, USDA Forest Service, North Central Research Station, Columbia, MO
W. Dustin Walter, University of Missouri, School of Natural Resources, Center for Agroforestry, Columbia, MO

Invited presentations to the Committee :

Kati Auman, Missouri Coalition for the Environment, St. Louis, MO
Scott Banbury, Dogwood Alliance, Memphis, TN
Bill Bryan, Assistant Attorney General, State of Missouri
Gerald Bryan, University of Missouri, Extension Division, Jackson, MO
Rick Cantrell, American Forest and Paper Association, Washington, D.C.
David Diamond, Missouri Resource Assessment Partnership (MORAP), Environmental Technology Center, Columbia, MO
Hank Dorst, Mark Twain Forest Watchers, Elk Creek, MO
Soren Erickson, Missouri Forest Products Association, Jefferson City, MO
Joseph Garvey, Missouri Department of Conservation, Jefferson City, MO
Toni Nenninger Goodwater, Missouri Coalition for the Environment, St. Louis, MO
James Guldin, USDA Forest Service, Southern Research Station, Hot Springs, AR
Charles Hirt, Canal Corporation, Scott City, MO
Rob Jacobson, U.S. Geological Survey, Environmental Research Center, Columbia, MO
Alan R.P. Journet, Southeast Missouri State University, Department of Biology, Cape Girardeau, MO

Tom Kruzen, Missouri Coalition for the Environment, Mountain View, MO
Lynn McClure, Missouri Forest Products Association, Jefferson City, Mo
Corey Ridenhour, Missouri Forest Products Association, Jefferson City, MO
Cielo Sand, Dogwood Alliance, Chattanooga, TN
Gary Schneider, University of Tennessee, College of Agricultural Sciences and Natural Resources, Knoxville, TN
Stephen R. Shifley, USDA Forest Service, North Central Research Station, Columbia, MO
Skip Stokes, Missouri Forest Products Association, Jefferson City, MO
John M. Wood, Westvaco Corporation, Wickliffe, KY

Information and assistance in compilation of Committee report:

John P. Dwyer, University of Missouri, School of Natural Resources, Department of Forestry, Columbia, MO
Stephen Galliher, Willamette Industries, Piedmont, MO
Charles Hirt, Canal Corporation, Scott City, MO
Mike Hoffman, Missouri Department of Conservation, Jefferson City, MO
Shelby Jones, Missouri Department of Conservation (retired), Consulting forester, Jefferson City, MO
David Hammer, University of Missouri, School of Natural Resources, Department of Soil Science, Columbia, MO
Rob Jacobson, U.S. Geological Survey, Environmental Research Center, Columbia, MO
John Kabrick, Missouri Department of Conservation, Columbia, MO
Tom Lange, Missouri Department of Natural Resources, Jefferson City, MO
Dan Shuette, Missouri Department of Natural Resources, Jefferson City, MO
Stephen R. Shifley, USDA Forest Service, North Central Research Station, Columbia, MO
Frank Thompson, USDA Forest Service, North Central Research Station, Columbia, MO
Clinton Trammel, Pioneer Forest, Salem, MO

Assistance in Committee process and procedures :

Brian Brookshire, Missouri Department of Conservation, Jefferson City, MO
Alice Geller, Missouri Department of Natural Resources, Jefferson City, MO
Bernard J. Lewis, University of Missouri, School of Natural Resources, Department of Forestry, Columbia, MO
Jerry L. Wade, University of Missouri, Extension Division -- Community Development, Columbia, MO
Llona C. Weiss, Missouri Department of Natural Resources, Jefferson City, MO